Vol. XIX No. 9

DISSERTATION ABSTRACTS

ABSTRACTS OF DISSERTATIONS AND MONOGRAPHS IN MICROFORM

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ANN ARBOR, MICHIGAN: 1959

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AGRICULTURE, GENERAL

TEACHING FARMER COOPERATION IN VOCATIONAL AGRICULTURE

(L. C. Card No. Mic 59-358)

Edmund Robert Barmettler, Ph.D.
The Ohio State University, 1958

Nationwide surveys involving state leaders of farmer cooperation and selected teachers of vocational agriculture and evaluations of programs of instruction by 50 selected teachers from Ohio, Indiana, Michigan, Pennsylvania, and Kentucky were used to determine the salient features in teaching farmer cooperation in vocational agriculture. The four major aspects of instruction for high school, young farmer, and adult farmer classes which were evaluated included (1) program content, (2) time devoted to instruction, (3) effectiveness of teaching aids and activities, and (4) teaching methods.

The subject groupings indicated in the programs of instruction as a result of the surveys and evaluation were —

1. Historical background information.
2. Philosophy, organization, operation, and functions of farmer cooperatives.
3. Cooperative purchasing of farm supplies.
4. Cooperative marketing of farm commodities.
5. Cooperative service procurement.

The average amount of time devoted to instruction in high school classes was 40 hours a year. It was distributed over the five areas as follows:

	Per Cent	Hour
Historical background	11	4.4
Organization of cooperatives	18	7.2
Cooperative purchasing	23	9.2
Cooperative marketing	22	8.8
Cooperative servicing	26	10.4
	100	40.0

The amount of time devoted to this instruction for the out-of-school groups was approximately 12 hours a year.

Teachers reported the use of three specific kinds of resources to aid in instruction. They were classified as (1) teacher resources, (2) activities resources, and (3) materials resources.

Among the teacher resources were those professional skills, attitudes, interests, and competencies needed in teaching. Another teacher resource involved the use of community leaders who by virtue of training, education, and position were able to supplement instructional programs.

Some of the activities resources identified in the study were those available to teachers and students through planning and organization within the community. Examples are field trips, resource persons, junior cooperative organizations, and cooperative-sponsored incentive activities. Teachers rated these resources most highly.

Material resources identified included literature, films, and other printed or graphic matter. School farms, F.F.A. chapter farms, and cooperative facilities were also classified as material resources.

Those resources which involved activity or participation by students and/or teachers were valued as being most effective in teaching farmer cooperation.

Three means of instruction in farmer cooperation were reported by teachers. These were (1) the functional approach, (2) the F.F.A. activities approach, and (3) the separate unit/s approach.

The functional approach involved providing instruction concerning farmer cooperation whenever and wherever instruction in any phase of agriculture being studied by a class or individual student could contribute to the understanding of farmer cooperation. The extensiveness of this method was governed by the functions of cooperatives in the community and by the student need as determined by the teacher. Instruction pertaining to cooperative purchasing, marketing, and servicing was generally included in this approach.

The F.F.A. activities approach, used by all teachers participating in the study, involved the integration of cooperative activities, both economic and non-economic, into the F.F.A. chapter's annual program. This method was found to be exceedingly effective in teaching business understanding through active participation.

The separate unit/s approach was widely used to supplement the other two methods. This involved the teaching of history, philosophy, organization, operation, and functions of cooperatives as specific units of instruction.

Teachers were agreed that the instruction should be related to the student's present interests and farming program problems. The final measures for determining the effectiveness of teaching were the observable changes in the student and his environment as well as the overt actions resulting from decisions made by learners.

Microfilm $4.65; Xerox $15.60. 364 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

ECONOMICS OF FORAGE PRODUCTION AND UTILIZATION, NORTH COUNTRY REGION, NEW YORK, 1955-56

(L. C. Card No. Mic 59-444)

George Robert Dawson, Ph.D.
Cornell University, 1958

Chairman: L. C. Cunningham

This study describes the production and utilization of forage crops on commercial dairy farms in the North Country Region of New York. The data were collected in conjunction with a larger study of the complete farm business and covers the 12-month period, May 1, 1955 to April 30, 1956.

The primary objectives of this study were (1) to examine and describe the physical resources of the commercial dairy farms, (2) to study the input-output relationships of forage production and utilization and (3) to determine which factors contributed most to high crop yields and a high rate of milk production.

The data were collected by the survey method. A 15 per cent sample of randomly distributed farms was studied from each of seven major soil areas within the region as well as for the region as a whole.

The cropland, crops produced, crop yields, fertilizer used, feeding practices and rate of milk production were described. The relationships of key factors in the production of crops, milk and income were studied. Basic financial information on receipts and expenses were presented.

The cool, humid climate and the soils of the region favor the production of grass and other forage crops. Hay was the dominant crop produced. Corn silage was produced on 51 per cent of the farms, grass silage on 16 per cent and oats for grain on 61 per cent. The farms averaged 89 acres of crops per farm.

For the region as a whole, the average yield of hay was about 6 per cent and of grain crops about 30 per cent below the average yields of the state. Hay was normally cut only once during the season.

One of the major factors contributing to increased crop yields was the intensity at which the cropland was stocked. With heavy stocking, more manure was available per total crop acre. Manure provided 85 per cent of the plant food available per total crop acre and farms with the most manure per total crop acre had the highest crop yields. Commercial fertilizer and lime were used on a limited scale.

On the whole, the region is self sufficient in terms of the hay produced and fed. There was a positive relation between the amount of hay equivalent fed per cow and the amount of milk sold per cow. The forage and grain feeding practices were obtained on each farm. Increased quantities of hay equivalent fed per cow resulted in increased amounts of milk sold per cow only when the hay equivalent consisted of increased proportions of silage. Increased grain feeding gave the greatest response in milk production when the forage was at one-third from silage.

In an effort to harvest more hay equivalent per cow, some farms intensified by increasing crop yields and others by expanding the number of acres operated. Both methods gave additional roughage but the increased yield approach was the most profitable.

The average size of herd was 27 cows per farm. Two per cent of the farms had herds of less than 10 cows and 5 per cent had herds of 50 cows or more. Heifers of all ages averaged 13 per farm.

Microfilm $2.15; Xerox $7.60. 161 pages.

PROGRAMMING REGIONAL ADJUSTMENTS IN RESOURCE USE FOR GRAIN PRODUCTION

(L. C. Card No. Mic 59-1130)

Alvin Charles Egbert, Ph.D.
Iowa State College, 1958

Supervisor: Earl O. Heady

A regional aggregative analysis of the wheat and feed grain* economy is described in this thesis. The general problem was concerned with the current surplus production existing in these industries. Surplus production problems of these grains cannot be investigated individually. The decrease in the quantity of one usually leads to an increase in the quantity of one or more of the others. However, recent developments in mathematical programming provide methods for analyzing these industries simultaneously.

The general objective of this study was to determine the optimum regional production of wheat and feed grain, and consequently specify the surplus grain producing regions in the United States in terms of economic efficiency criteria, given certain production restraints, prices and costs. These restraints are the quantities of land "usable" for grain production in each region, plus the quantities of wheat and feed grain required for human and livestock consumption at a point in time. Given the production restraints, prices and production costs, the optimum regional location of production is determined by those regions that produce the grain requirements at (a) minimum total cost or (b) maximum total profit; depending on the assumptions of the analysis.

One hundred four unique major grain producing regions in the United States were delineated for this investigation.

The base year, 1954, was used to determine production costs, prices, grain yields and consumption requirements, but 1953 was the base year for estimating maximum grain acreages. Four programming models were used in analyzing the problem of optimum production location of wheat and feed grain. The models are designated as Ia, Ib, II and III. Specific maximum regional grain acreages are common to all four models. Food wheat, feed wheat and a feed grain rotation are the regional production possibilities in Models Ia, Ib, and III, but for Model II the production possibilities are food wheat, feed wheat, corn, oats, barley and grain sorghums. Other differences between the models are: (a) Models Ia, Ib and II are minimum total production cost models, but Model III is a maximum total profit model, and (b) an annual land rental is included in each activity production cost for Model Ib but not in Models Ia, II and III.

The optimum solutions (obtained by the simplex method of linear programming) for Model Ia, Ib and III show a high degree of similarity in terms of the specified location of grain production. (Model Ia, Ib and III are the more realistic of the four models and taken together possibly provide a basis for specifying where grain resource adjustments should take place.) For these three model solutions,

never is wheat and feed grain production specified for Michigan, Southeastern Colorado, Eastern New Mexico, and the Delta States. Too, feed grain production is never specified for the Southeast; and a small quantity of wheat only for the Model III solution. Conversely, wheat production is never designated for the Appalachian area, but a small quantity of feed grain is specified for Western Kentucky and Eastern Virginia in this area by the solution to Model III. On the basis of this study, then, these areas, where little or no grain production is ever specified are those in which most of the contractive resource adjustments in grain production should take place.

Conceptually, the models used for this study were relatively small and simplified, even so, data problems and costs were of considerable magnitude.

Microfilm $4.25; Xerox $14.20. 329 pages.

*Corn, oats, barley, and grain sorghums.

INSECTICIDE TREATMENT OF MANURE FOR CONTROL OF HOUSEFLIES WITH NOTES ON THE CONTROL OF CATTLE LICE AND THE SHEEP TICK

(L. C. Card No. Mic 59-125)

Leo Dale Haws, Ph.D.
Cornell University, 1958

Eight insecticides were investigated to determine their toxicity to eggs of the housefly, M. domestica L. The toxic effects of the insecticide to the animals confined in treated calf pens was also investigated. From the experimental work presented it was evident that:

1. Movement of the larvae of houseflies in manure from gutters treated with insecticides is great enough to make it practically impossible for them to live without coming in contact with a treated surface.

2. Of the eight insecticides tested diazinon was the most effective in controlling houseflies. At a concentration of 0.063 per cent it gave 100 per cent control. Thiodan gave 100 per cent control when used at 0.125 per cent. Korlan was effective at 0.25 per cent in killing 100 per cent of the houseflies. Malathion and dipterex gave 100 per cent control at 0.5 per cent. Thiourea required a one per cent concentration to give complete control. Sevin and RE-4355 did not give satisfactory control at the concentrations tested (0.25 per cent to 0.063 per cent).

3. Manure is attractive to flies for oviposition for at least three weeks.

4. Diazinon controls or prevents oviposition in manure for at least three weeks.

5. Cow manure is a good media for breeding houseflies. Approximately 45.6 per cent survival of adult houseflies when reared in this medium and under ideal conditions can be expected.

6. The mite of the suborder Mesostigmata, genus Macrocheles by feeding on the eggs of houseflies may account for a very large part of the natural control of houseflies.

7. The method described by McOsker and Daniel is a satisfactory method for cholinesterase analysis.

8. Under the winter conditions of this experiment diazinon at the one and three per cent level will cause a depression of cholinesterase of about 50 per cent in calves confined in pens and treated weekly.

9. One hundred per cent of housefly eggs will be killed when they are placed in manure that has been treated with 0.063 per cent diazinon and at this same concentration no depression of cholinesterase can be demonstrated in exposed calves.

10. Fat samples taken from various tissues of animals confined in pens that were treated with one and three per cent diazinon showed apparent residues of this insecticide. However, a check of this apparent diazinon content by the cholinesterase procedure yielded 0.000 ppm diazinon.

As a result of this work it was shown that ectoparasites could be controlled by the manure treatments. A summary of the experiments conducted for the control of ectoparasites is given below:

1. Control of sheep tick can be accomplished with a 0.25 per cent solution of diazinon applied at the rate of one gallon to 100 sq ft of manure surface.

2. Cattle lice can be controlled by treating the bedding with a one per cent solution of diazinon at the rate of one gallon to 100 sq ft of manure surface.

Microfilm $2.00; Xerox $6.80. 142 pages.

THE RELATION OF VARIATIONS IN EDUCATION TO THE DECISION-MAKING OF FARMERS

(L. C. Card No. Mic 59-404)

Robert Benton Schwart, Ph.D.
The Ohio State University, 1958

Technological and economic changes taking place in agriculture have brought about a change in thinking with regard to the management function of the farmer. The farmer in assuming his role of manager must perform the following functions: observation, analysis, decision-making, action-taking, and the acceptance of economic consequences.

The purpose of this study is to determine the influence of education, measured by grade completed in school by farmers, on the decision-making processes. The study concerns itself with following decision-making processes: analytical methods, price and production models, knowledge situations, insurance strategies, types of information needed, and sources of information.

The data used in relating education to the decision-making processes of farmers were obtained from the responses of 1,075 farmers interviewed in the seven states cooperating in the Interstate Farm Management Survey conducted in 1954 and 1955. The farmers interviewed were commercial farmers with a gross farm income of $2,500 or more having single household managerial units.

Information was obtained on variables in addition to education which may have influenced the response of farmers. Variables most likely to modify farmers responses were appraised to determine their effect on the replies. Most of the variables that may have modified the responses of farmers independent of education were closely associated with the age of the operator, but it was found that age would not invalidate the relationship of education to the decision-making processes.

Gross farm income and net worth were used in the

survey as indicators of the successfulness of farmers in making decisions. There was a direct relationship among the gross farm income, net worth, and level of education.

In general, the managerial processes were associated with education level of farmers. In many of the responses the relationship of education to the managerial processes was not statistically significant, but the relationship was strongly suggested by much of the data.

The responses of farmers dealing with analytical methods indicate that education is directly associated with understanding marginal analysis, although it was understood by only about 28 per cent of the farmers. The use of inductive and deductive reasoning was understood by less than 25 per cent of the farmers.

Models used by farmers in determining prices or production patterns indicated no significant relationship to education level, although the influence suggests that as grade level is increased farmers tend to use more complete and reliable models in arriving at decisions.

Farmers' responses to the insurance strategy questions indicated no relationship to education.

The proportion of farmers able to give examples of all types of knowledge situations was directly related to education.

According to farmers the types of information needed to make decisions were price, production, new developments, human and institutional information. The types of information needed were not significantly influenced by level of education.

The sources of information used by farmers were not significantly influenced by education. Farmers completing higher levels of education did use a greater number of sources of information and made more use of information from agricultural college representatives and experiment station personnel.

It may be concluded that the management of farms is improved by the completion of more formal education by farmers.

Although the level of education of farmers will increase in the years ahead, without more emphasis on the development of managerial ability by both the formal school system and adult educational programs, the level of management will not be improved appreciably in relation to the expected technological and economic changes in agriculture. Microfilm $2.75; Xerox $9.40. 209 pages.

GENETIC AND ENVIRONMENTAL FACTORS IN BREEDING SMOOTH BROMEGRASS, BROMUS INERMIS LEYSS

(L. C. Card No. Mic 59-1150)

John Dimond Truscott, Ph.D.
Iowa State College, 1958

Supervisor: Robert R. Kalton

Several northern and southern strains of bromegrass were introduced into Manitoba and evaluated for seed yield and its components and for forage yield under different management conditions. Twenty-three entries were compared in a solid-seeded, split plot test for 3 years using two levels of nitrogen application to contrast performance for seed yield, panicle production, fertility index and seed weight. Twelve entries were compared similarly for forage yield in a second test. These 12 entries also were included in a third, space-planted test and evaluated in 1955 only to contrast performance for seed yield and its components under nursery conditions and to permit comparisons under two methods of planting. Two clonal entries were included in this test to enable estimation of heritabilities for seed yield and its components. Plant-to-plant variability exhibited by entries also was studied to determine potentialities as source material for breeding for improved seed production.

In the Seed Yield Test entry differences were highly significant each year, with northern and southern entries averaging 390 and 302 pounds of seed per acre, respectively, on a 3-year mean basis. Nitrogen fertilization increased average seed yield of all southern types by 69 pounds and all northern types by 43 pounds per acre. Southern entries produced significantly more panicles than northern and in the second year of testing showed a greater response to fertilization. Three-year mean fertility indexes for the northern and southern groups were 0.658 and 0.599, respectively (significantly different at 1% level). Differences between groups in mean seed weight also were highly significant, northern being heavier.

Partial-correlations between seed yield and its components: panicle rating, fertility index and seed weight for all entries in the Seed Yield Test were 0.67, 0.72 and 0.52, respectively. In the same order, partial-correlations within the northern group only were 0.71, 0.60 and 0.28, while those in the southern group only were 0.81, 0.74 and -0.09. Degrees of relationship among components of yield varied somewhat between types.

Mean green forage yield of all southern entries was 9.4 pounds per plot compared with 8.8 pounds for all northern entries for a 3-year period. In the third year, southern types responded significantly more than northern to nitrogen application.

Estimates of genotypic variation for seed yield and its components among plants in the Space-planted Test were 39, 16 and 68% for seed yield, panicle production and fertility index, respectively. Plant-to-plant variability seemed to be sufficiently great to permit selection in desirable source material on a logical basis. Fertility index appeared to be a relatively stable trait and heavy selection pressure in spaced nurseries should be possible. Panicle production was markedly affected by the environment and selection for change on this trait probably would be more successful in solid-planted progeny tests.

Microfilm $2.00; Xerox $5.20. 104 pages.

AGRICULTURE, ANIMAL CULTURE

EFFECT OF PROTEIN INTAKE ON WEIGHT CHANGES, BLOOD CONSTITUENTS AND REPRODUCTION IN BEEF HEIFERS

(L. C. Card No. Mic 58-3478)

Eliezer Bedrak, Ph.D.
The University of Florida, 1958

These investigations were designed to study the protein requirements needed for growth and reproduction of heifers, under North Florida conditions, to elucidate some of the physiological changes induced by a protein deficiency and to establish laboratory tests suitable for identifying protein deficiency as it occurs with growing cattle.

Twenty yearling and twenty two-year-old Angus, Hereford and Angus-Hereford crossbred heifers were individually fed a ration consisting of different levels of digestible protein, but comparable amounts of energy, minerals and vitamins for a period of 159 to 207 days. The following criteria were investigated: feed consumption, daily gain in body weight, feed efficiency, hematological changes, liver protein concentration, xanthine oxidase activity in liver and uterus, endocrine histology, estrual behavior, ovarian activity, early embryonic development and gonadotrophin activity.

Yearling heifers consuming less than 0.51 pound of digestible protein daily showed depressed appetite, made unsatisfactory gains in body weight and had inefficient feed utilization. These animals exhibited delayed puberty, a long anestrous period, failure to show heat, failure of ovulation, weak expression of estrus and early embryonic mortality. Moderate protein deficiency produced in two-year-old heifers consuming less than 0.74 pound digestible protein daily caused depressed appetite, inadequate gains in body weight and poor feed utilization. These animals showed somewhat lower reproductive performance. Of the heifers that conceived the length of estrous cycles, conception rate and embryonic development to 44 days of pregnancy were not affected by the low levels of digestible protein used. The total amount of Follicle Stimulating Hormone apparently was comparable in heifers of all groups. However, a tendency was observed for lower levels of Luteinizing Hormone among the heifers where the dietary protein levels were the lowest. Thus, it appeared that the minimum protein requirements for adequate wintering growth and reproductive performance and early gestation under North Central Florida conditions could be met by feeding 0.51 and 0.74 pound digestible protein daily to yearling and two-year-old beef heifers weighing 600 and 750 pounds, respectively.

Low levels of protein intakes of 0.21 and 0.38 pound in yearling and two-year-old heifers, respectively, caused lowered hemoglobin and hematocrit concentrations. The clinical anemia produced was due to a decreased number of erythrocytes while no changes occurred in the leukocytes of blood volume. Likewise, the protein deficiency produced did not affect the concentration of the inorganic phosphorus and calcium of the blood plasma. The decline in serum protein content, which was primarily due to a decrease in albumin concentration of animals fed low levels of digestible protein was not associated with an increase in blood creatinine. The $alpha_1$ and gamma globulins increased in blood serum of heifers consuming low levels of digestible protein; whereas no alterations occurred in concentration of $alpha_2$ and beta globulin fractions. A marked decline in concentration of crude protein occurred in the liver of heifers consuming low levels of dietary protein, whereas the xanthine activity per milligram nitrogen was higher than the enzyme activity observed in the liver of the animals where the intake of protein was adequate.

Several clinical tests for identification of protein deficiency, such as was produced in these studies, in growing beef heifers were proposed. These are:

a). Determination of protein concentration in blood serum with simultaneous fractionation of $alpha_1$ globulin

b). Analysis of crude protein in the liver and determination of xanthine oxidase activity per milligram of nitrogen.

Microfilm $2.05; Xerox $7.20. 155 pages.

FACTORS AFFECTING NUTRIENT UTILIZATION BY DAIRY CALVES

(L. C. Card No. Mic 59-1143)

Lantis Ratcliff, Ph.D.
Iowa State College, 1958

Supervisor: N. L. Jacobson

Two experiments were conducted to study factors affecting nutrient utilization by dairy calves. In Experiment I, 16 Holstein calves (8 males and 8 females) were divided into two comparable groups. All calves in Group I received whole milk (for 7 weeks), starter, and hay; half the calves of each sex received a milk replacer, composed of finely ground dry feeds plus water, from the 4th- through the 11th-week. Calves in Group II were fed similarly to those in Group I except each calf received pepsin (1:3000 N.F.) and animal diastase (6X U.S.P.) at the rate of one percent and 0.167 percent, respectively, of dry matter intake. The addition of these enzymes did not appear to improve body weight gains. Calves fed enzymes gain slightly less and consumed less feed than the calves not fed enzymes.

In Experiment II, 24 Holstein calves (12 males and 12 females) were fed limited whole milk for six weeks and liquid milk replacer from three to 12 weeks by nipple. Half the calves of each sex received a milk replacer containing dried skimmilk, dextrose, distillers dried solubles, and soybean oil meal; the others received a similar replacer minus the distillers dried solubles. Hay and starter were fed to females for 12 weeks and to males after seven weeks. The males were on screens (no bedding) for the first seven weeks. Digestion trials were conducted, using the males, during the 7th and 11th weeks. Blood samples were taken each week for determination of percent plasma, hemoglobin and reducing sugar levels.

The average weight gains for the two groups of males were about equal throughout the experiment. The females receiving distillers solubles gained slightly more and seemed to utilize their feed more efficiently than the females receiving no distillers dried solubles. The difference in mean weight gains of the females was not statistically significant.

There was a high incidence of diarrhea and excessive flatulence in the calves which did not receive distillers solubles.

In the digestion trial conducted during the 7th week, apparent digestion coefficients for the males not receiving distillers dried solubles, were significantly higher ($P < .05$) for dry matter, protein, and ash; and the difference in starch equivalent digestibility was significant ($P < .01$) in favor of the males not fed distillers solubles. Ether extract digestion was significantly greater ($P < .05$) in the males fed distillers solubles. In the second trial (during the 11th week) the only appreciable difference in digestibility of the various nutrients between the two groups was in ether extract, which was significantly greater ($P < .05$) in the calves fed distillers dried solubles.

Hemoglobin values for calves fed distillers dried solubles were significantly higher ($P < .05$) than those for the other calves.

Whole blood reducing sugar values declined for eight weeks, and limiting some of the calves (males) to a liquid diet fed by nipple did not alter appreciably the nature of these trends. Most of the reducing sugar was in the plasma, where trends were similar to those of whole blood.

Microfilm $2.00; Xerox $4.80. 92 pages.

A STUDY OF THE FATTY ACID COMPOSITION OF THE REICHERT-MEISSL AND POLENSKE FRACTIONS OF BUTTERFAT AND ITS ADMIXTURES WITH OTHER FATS

(L. C. Card No. Mic 59-138)

Arun Sengupta, Ph.D.
Cornell University, 1958

The determination of Reichert-Meissl value as a means of detecting adulteration has been in use for nearly eighty years. In spite of this fact, thorough studies have not yet been made on many of the factors involved in the method (1). This research was undertaken to clarify some of these factors. An investigation was made to determine (1) the fatty acid composition of the Reichert-Meissl and Polenske fractions of butterfat, (2) the effects of adulteration of butterfat with other fat on some of the fatty acids of the Reichert-Meissl fraction, and (3) the effect of cooling the Reichert-Meissl-Polenske distillate on the distribution of fatty acids between the Reichert-Meissl and Polenske fractions.

The study on the composition of fatty acids in the Reichert-Meissl and Polenske fractions was carried out by the chromatographic method of Nijkamp (3). The composition of the Reichert-Meissl fraction of a butterfat sample was found to be 65.3 percent butyric acid, 30.1 percent caproic acid and 4.6 percent caprylic acid. The Polenske fraction was comprised of 0.6 percent of butyric and caproic acids, 22.1 percent of caprylic acid and 76.7 percent of capric and higher acids. For comparison, the Reichert-Meissl of coconut fat was found to consist of 27.5 and 72.5 percent of caproic and caprylic acids respectively, whereas the Polenske fraction was made up of 54.5 percent of caprylic acid and 45.5 percent of capric and higher acids.

It is to be noted that caprylic acid divides itself between the Reichert-Meissl and Polenske fractions and forms the boundary between these two fractions.

The study on the effect of adulteration of butterfat on the fatty acid composition of the Reichert-Meissl fraction was carried out by chromatographic method of Keeney (2). This column permitted the separation of butyric acid from all other higher acids. Since the Reichert-Meissl fraction of butterfat consisted of butyric acid and caproic and caprylic acids, the latter two acids separated out in a group from butyric acid.

This study indicated that when butter fat was adulterated to the extent of 10, 20 and 30 percent by fats of low Reichert-Meissl and Polenske values, both butyric acid and caproic-caprylic acids group were reduced in the amounts corresponding to percent adulteration. However, if the adulterant is coconut fat then the caproic-caprylic acid content remained almost constant and had practically the same value as the pure butter fat but the butyric acid content was reduced by an amount corresponding to the percent adulteration like any other fat.

The reason for the constancy in the amounts of caproic and caprylic acids group was investigated. It was found that an increase in adulteration up to the extent of 30 percent caused an increase in the caprylic acid and a decrease in the caproic acid in such a manner that the sum total of the two acids remained practically constant. This distinction in the caproic-caprylic acids could, therefore, be used as a means of detecting the presence of coconut fat.

The amount of butyric acid recovered in the Reichert-Meissl distillate indicated that all of the butyric acid of butter fat distilled over.

The effects of cooling of the Reichert-Meissl-Polenske distillate to the temperature of 6° C. for 20 minutes were (1) the solidification of the Polenske fraction, (2) an increase in the Polenske value which equalled the sum of the loss of acidity in the Reichert-Meissl fraction and that in the wash water, (3) caprylic acid was found to be primarily responsible for this shift in acidity in the various fractions.

References

1. Association of Official Agricultural Chemists. Official and Tentative Methods of Analysis, 7th Edition. 1950.
2. Keeney, M. Chromatographic Determination of Butyric Acid and the Detection of Milk Fat Adulteration. Misc. Publication, 153, January 1953. Univ. of Maryland Agri. Experiment Sta., College Park, Md.
3. Nijkamp, H. J. On the Chromatographic Determination of Volatile Fatty Acids, C_4-C_{10}. Analytica Chimica Acta, 5:325. 1951.

Microfilm $2.00; Xerox $3.00. 35 pages.

EFFICIENCY OF TESTING SCHEMES IN SWINE

(L. C. Card No. Mic 59-1144)

Charles Smith, Ph.D.
Iowa State College, 1958

Supervisor: Dr. L. N. Hazel

Extensions have been developed for the method of Robertson[1] to determine the optimum group size in a progeny test or sib test. These extensions represent three methods of selection in swine, namely selecting tested

animals, selecting both tested animals and their relatives, and selecting the relatives only as in a slaughter test. An example comparing the improvement from testing and selection under these three methods has been given, encompassing a wide choice of testing possibilities.

The extent of the improvement is proportional to log N/T, where N is the number tested and T is the number of breeding stock required, and to the heritability of the trait being considered. Further modification of improvement depends on the size and the type of family represented by the test group, and on the intra-group correlations in the test. At large values of N/T a high accuracy is important in evaluation. Consequently selection of animals actually tested, either as individuals or as groups, is superior in such cases. As N/T decreases the existence of untested relatives becomes important because fewer animals may be tested than are required. At low values of N/T the proportion of tested animals among those selected is small, the test group size is small and the overall relationship to tested animals is small (r = .25). Under such conditions the genetic improvement can only be small. The slaughter test will always be less efficient than an individual performance test as the tested animals will be slaughtered and not included among those selected, but at low values of N/T the difference will be small. The larger the family size in any category and the smaller the intra-group correlation at some level at heritability, the greater will be the improvement from testing.

Of perhaps more importance in livestock improvement is how the testing system is integrated with the population structure. If, for example, selected animals are used solely to sire commercial stock no accumulation of merit can occur in the breeding herds. Where any breeder may test entries the maximum improvement will be obtained when all pedigree herds use sires highly related to animals selected on the basis of the test. The less that this is achieved, either by testing insufficient numbers, or by refusal of the breeders to cooperate the less the improvement from testing will be. The effective size of T, the number required for breeding, can be greatly reduced by considering only a nucleus group of breeders, and using all the testing facilities and opportunity for selection on their stock. This system seems to give maximum improvement when all pedigree breeders use males from this nucleus. When facilities are limited and such a structure exists in the population, this design will give the greatest improvement.

Other aspects of testing work have been considered viz., the use of the progeny test, on-the-farm testing, selection for several traits and the educational and political aspects of testing.

Microfilm $2.00; Xerox $6.00. 122 pages.

1. A. Robertson. 1957. Optimum group size in progeny testing and family selection. Biometrics 13:442-450.

THE EFFECT OF VARIOUS ESTROGENIC AND ANDROGENIC COMPOUNDS UPON THE RATE OF GROWTH AND RATIO OF LEAN TO FAT IN THE CARCASSES OF GROWING-FINISHING SWINE

(L. C. Card No. Mic 58-3201)

George Walter Thrasher, Ph.D.
Purdue University, 1958

Major Professor: T. W. Perry

Three trials were conducted with weanling pigs in which attempts were made to improve the rate of gain, efficiency of feed utilization and ratio of lean to fat in growing-finishing swine by feeding testosterone derivatives and utilizing various combinations of oral and subcutaneous administration of stilbestrol and testosterone. Carcass measurements were made at a final market weight of 210 pounds to estimate the relative leanness of individual swine carcasses. Measurements used were live backfat depth, chilled carcass backfat depth, dressing percentage, per cent of primal cuts and chemical analyses of the edible portion of the carcass for moisture, fat, protein, ash and iodine number of depot fat. Standard procedures for measurements and analyses were used.

In Trial I conducted during the winter of 1956-57, 60 weanling, linebred Hampshire pigs were divided according to sex and liveweight into 6 lots of 10 pigs each and fed a complete mixed basal ration consisting of ground yellow corn, soybean oil meal, meat and bone scraps, alfalfa meal, salt, vitamins and antibiotics. The lot treatments of hormones in milligrams per pound of ration were as follows: control, 5.0 mg. of methyl testosterone, 0.6 mg. of Halotestin (9a-fluoro-11B-hydroxy-17a-methyl testosterone), 0.4 and 2.0 mg. of Nilevar (17-ethyl-19 nortestosterone) and 0.6 mg. of 11B-hydroxy-17a-methyl testosterone. None of these treatments had any significant effect upon the rate of gain of swine. However, pigs fed the 2.0 mg. level of Nilevar per pound of ration had a 0.15 pound reduction in average daily gain and required nearly 6 per cent more feed per 100 pounds of gain than the control lot after 90 days on trial. Other groups had quite similar average daily gains, feed consumption and feed efficiency data. No significant differences in carcass data were found between groups. Nevertheless, the lot fed methyl testosterone showed a tendency toward improved carcass leanness over the control lot when various carcass data were compared. The feeding of methyl testosterone highly significantly increased the iodine number of the depot fat of pigs when compared to control pigs.

Trial II was conducted during the summer of 1957 and involved 60 weanling, purebred, Duroc pigs divided into 6 lots of 10 pigs each according to liveweight. Pigs were fed a basal ration of ad libitum separately fed shelled yellow corn, mineral mixture and a protein supplement consisting of soybean oil meal, meat and bone scraps, alfalfa meal, salt, vitamins and antibiotics. The treatments and sex divisions were as follows: barrow and gilt control group, barrows fed 1.0 mg. of stilbestrol per pound of protein supplement, boars fed 1.0 mg. (later increased gradually to 5.0 mg.) of stilbestrol and castrated at 172 pounds average liveweight, barrows and gilts fed 1.0 and 20.0 mg. of stilbestrol and methyl testosterone, respectively, per pound of protein supplement, barrows and gilts fed 1.0 mg. of stilbestrol per pound of protein supplement and implanted

with 50 mg. of testosterone propionate per pig and barrows and gilts implanted with 3.0 and 50.0 mg. of stilbestrol and testosterone propionate, respectively, per pig. The differences in average daily gain between all groups were slight and insignificant at the final weight of 210 pounds. Although differences in gain were not significant, boars tended to gain more rapidly prior to castration than barrows but lost this difference after castration. The group fed stilbestrol and methyl testosterone had a slight but insignificant lower average daily gain than controls after 84 days on treatment. Gains and feed efficiency of barrows fed stilbestrol, barrows and gilts fed stilbestrol and implanted with testosterone and barrows and gilts implanted with stilbestrol and testosterone were slightly improved over the control group of barrows and gilts. Boars ate less corn than barrows throughout the trial and required 7 per cent less feed per 100 pounds of gain at the time of castration. Pigs fed stilbestrol and methyl testosterone consumed 4.5 per cent less corn per day and required 4.5 per cent less total feed per 100 pounds gain for the entire trial. When compared separately, boars had significantly ($P<0.05$) less live backfat depth with the following measurements: Average, last rib and last lumbar. Differences for other groups were not significant. Feeding or implanting stilbestrol at the previously mentioned levels, caused a stimulation in the size of vulvae and teats when administered with implants of testosterone propionate. The implant of stilbestrol produced greater side effects than orally administered stilbestrol with the levels used. Stilbestrol fed alone to barrows and boars increased teat length. Methyl testosterone caused erection of the tips of vulvae when fed with stilbestrol. This condition was somewhat evident in gilts implanted with testosterone propionate and fed stilbestrol. An outward appearance of increased body length and trimness was associated with the feeding of the combination of methyl testosterone and stilbestrol. The feeding of stilbestrol to boars did not cause a marked atrophy of testicle size; however, a comparison of combined testes weights, tubular diameter and degree of spermatogenesis with an earlier study revealed that some testes atrophy due to treatment did likely occur.

Sixty weanling, purebred Duroc pigs were divided equally into 6 lots of 10 pigs each according to sex and liveweight for Trial III conducted during the winter of 1957-58. Pigs in this trial were fed a basal ration consisting of ground yellow corn, soybean meal, meat and bone scraps, alfalfa meal, salt, vitamins and antibiotics. The following milligram levels of 11 B-hydroxy-17a-methyl testosterone were fed per pound of ration: 0, 0.3, 0.6, 0.9, 1.2 and 1.8. None of the levels had any significant effect upon the average daily gain of growing-finishing swine. Differences in average daily feed consumption and feed per 100 pounds of gain were slight. All treated groups had less live backfat depth than the controls. However, the backfat depth at the shoulder measurement for the lot fed 0.3 milligrams per pound of feed was the only significant difference from the controls ($P<0.05$). Carcass studies with the control group and the group fed 0.9 mg. per pound of ration revealed no significant differences in dressing percentage, standard carcass measurements, per cent of lean cuts or chemical analyses of edible portion of the carcass. Data for backfat depth, per cent of ham, loin, Boston butt, picnic, 4 lean cuts, belly, fat back and jowl and per cent of moisture and fat in the carcass all favored a tendency toward leanness of the treated group when compared to the control group.

Microfilm $2.00; Xerox $6.20. 128 pages.

AGRICULTURE, FORESTRY AND WILDLIFE

THE BREEDING BIOLOGY AND MANAGEMENT OF THE BLUE GOOSE CHEN CAERULESCENS

(L. C. Card No. Mic 59-443)

Frederick Graham Cooch, Ph.D.
Cornell University, 1958

Blue Geese (Chen caerulescens) breed in 14 major concentrations from Baffin Island to Siberia. Areas selected are palaeozoic basins, drained by braided deltas, within five miles of the sea. Blue Geese and Lesser Snow Geese (Chen hyperborea) are considered to be con-specific and color phases of Chen caerulescens. The epicenter of blue abundance is at Bowman Bay, Baffin Island, but the frequency of blue genes is spreading rapidly, especially in the Hudson Bay drainage. This increase is considered to be an example of adaptive polymorphism, which under present conditions, favors blue-phase birds. Mixed pairing occurs, but the frequency is not random because of imprinting of young to parental type. Progeny from mixed pairs are predominately blue-phase.

No behavioral differences are noted between the phases, but slight differences exist in the nature of the nesting curve, which in some seasons selects against white-phase birds. The nest initiation span has never exceeded 10 days since the study began in 1952. Basic clutch size is 4.42, but the number of eggs surviving to hatching is dependent on the phenology of the breeding season. Both phases are more successful in early breeding seasons than in retarded ones, but blue-phase birds and mixed pairs are always more successful than white-phase birds. Females do all incubation, nest construction and brooding, males and females defend young and territory. Conditions of the habitat permitting, the same nesting sites are used on successive years. No re-nesting occurs and birds losing complete clutches enter post-nuptial molt at same time as sub-adults. Incubation period is 23 days, but varies with clutch size, and weather conditions at time of hatching. White-phase birds have a slightly shorter incubation period than blue-phase birds. Sub-adults and failed-breeders molt in July, but adults with young enter post-nuptial molt in August. The flightless period is approximately 24 days, but short escape glides are attempted at 18 days. The growth of the goslings is rapid, and they weigh 80 ounces by 80 days. Fledging of young occurs at 49 days and coincides with the end of post-nuptial molt in adults. Normally, family groups remain intact for 11 months. Minimum breeding age is 23 months but average is 35 months. Pairs are formed by long-term association, but in eastern North America, most mating is assumed to occur in May. Populations winter and migrate as discrete entities. Autumn migration is often made non-stop from James Bay to the Gulf of Mexico, and at elevations in excess of 5,000 feet. In delayed breeding season, migration is interrupted in mid-western United States. Occurrence of various migration patterns, dependent on date of first nesting, are predictable. Banding techniques have been devised for mass-trapping flightless geese; 24,860 birds have been banded on the breeding grounds in five seasons. To date, 2867 bands have been reported, with a significantly higher rate of return obtained from white-phase geese.

Microfilm $3.20; Xerox $11.00. 246 pages.

AGRICULTURE, PLANT CULTURE

INVESTIGATIONS IN INTERSPECIFIC HYBRIDIZATION AND FERTILITY OF CERTAIN LOTUS SPECIES

(L. C. Card No. Mic 59-116)

Forrest Conser Bent, Ph.D.
Cornell University, 1958

Fertility relationships were studied within and among the following groups: natural diploid L. tenuis (2n=12), experimental autotetraploid L. tenuis (2n=24), natural diploid L. uliginosus (2n=12), experimental autotetraploid L. uliginosus (2n=24), natural tetraploid L. corniculatus (2n=24), and natural diploid L. corniculatus var japonicus (2n=12). It was found that the droplet method of colchicine treatment was satisfactory for inducing polyploidy in L. tenuis and L. uliginosus. Polyploids could be identified by length of the stomata, number of stomata per field when viewed at 500X, and the shape of the pollen grains on a dry mount. Chromosome counts were used to confirm the identification.

Prior to investigating the compatibility relationships within each of the groups it was found that emasculation followed by a two-day delay was a satisfactory method to enable safe crossing within the self-compatible groups. Earlier reports of self-compatibility in L. uliginosus and L. corniculatus var japonicus were confirmed. Evidence indicated that the S-alleles system of inheritance of incompatibility by itself does not satisfactorily explain compatibility reactions in L. tenuis.

Greater success was achieved in interspecific hybridization than previously reported, although more work is necessary in elucidating the techniques. Variations in morphological characteristics and the HCN test were useful in detecting hybrids. Three new interspecific hybrids, 2n L. uliginosus x 2n L. tenuis, 2n L. uliginosus x L. corniculatus, and 4n L. uliginosus x L. corniculatus, were obtained by means of embryo culture in addition to hybrids from crosses between 4n L. tenuis and L. corniculatus which had been reported previously. In thirteen other crosses among the six groups abnormal development of the embryos indicated that it might be possible to obtain hybrids.

One seedling was obtained from 2n L. uliginosus x 2n L. tenuis crosses. It had 12 somatic chromosomes and was sterile. The hybrid was significantly different from L. uliginosus in four morphological characteristics studied and significantly different from both parents in one. It was not significantly different from either parent in four characteristics. The HCN reaction resembled L. tenuis.

Two interspecific triploid seedlings were obtained from 2n L. uliginosus x L. corniculatus crosses and had 18 somatic chromosomes. One was normal in growth rate and the other was greatly retarded. The normal one was self-incompatible and did not cross with either parent species. It was compatible with certain of the 4n L. uliginosus x L. corniculatus hybrids. The triploids were significantly different from L. uliginosus in three morphological characteristics studied, from L. corniculatus in one, and from both parents in three. There were no significant differences in four characteristics. The HCN reaction resembled L. corniculatus.

Seven hybrids were obtained from 4n L. uliginosus x L. corniculatus crosses and each had a somatic chromosome number of 24. Six of the hybrids were normal in growth rate and one was greatly retarded. Fertility was studied in five of the hybrids. One hybrid was self-compatible, male sterile, and female fertile; one was self-incompatible, male sterile, and female fertile; and three were self-incompatible, male fertile, and female sterile. The hybrids were significantly different from L. uliginosus in two morphological characteristics studied, significantly different from L. corniculatus in four, and significantly different from both parents in two. There were no significant differences in two characteristics. The HCN reaction resembled L. corniculatus.

Microfilm $2.00; Xerox $6.00. 123 pages.

PHYSIOLOGICAL DIFFERENCES IN CELERY VARIETIES IN RELATION TO PITHINESS

(L. C. Card No. Mic 59-118)

Dermot Patrick Coyne, Ph.D.
Cornell University, 1958

Some varieties of celery, such as Summer Pascal and Emerson Pascal, when grown in New York State are very susceptible to pithiness while other varieties, such as Utah, are resistant. Pithiness is associated with maturity of the plants and may develop in the outer petioles either in the field or in storage. An investigation was conducted in order to find out if there were physiological and anatomical differences between celery varieties associated with resistance and susceptibility to pithiness.

The method of plasmolysis and neutral red staining was used to study cell viability in celery petioles. It was found that pithiness was preceded by the death of the parenchyma cells. After death the parenchyma cells collapsed and formed cavities in the center of the petioles.

Fresh weights, dry weights, and percentage dry weight of petioles, and percentage soluble solids of petioles and foliage were determined in different celery varieties at intervals in cold storage 32°F. The varieties which became very pithy in storage lost a significant amount of fresh weight and dry weight. The decline in fresh weight of the petioles was due largely to loss of moisture. Utah, which showed no significant change in fresh weight or dry weight, did not go pithy. There was no association between the percentage soluble solids content of the plant and the degree of pithiness.

Tissue cellulose of the outer and inner petioles of celery varieties was analyzed and evaluated. The intrinsic viscosity of the cellulose was significantly lower and the percentage cellulose of the fresh tissue was significantly higher in the pithy outer petioles of Emerson Pascal than in either the non-pithy inner petioles of the same variety, or in the non-pithy outer and inner petioles of Utah 15.

The respiration rate of tissue cylinders removed from the outer petioles of different varieties was measured by the Warburg direct method. No significant difference in respiration rate was observed between non-pithy petioles of different varieties. On the whole, the respiration rate was significantly higher in the very pithy petioles than in the non-pithy and slightly pithy petioles. It is suggested that the increase in respiration rate of pithy petioles

compared to non-pithy petioles is caused by a loss of respiratory control as cell senescence begins.

The effect of temperature on the development of pithiness was investigated. The degree of pithiness was significantly higher in Utah and Summer Pascal grown in the greenhouse where the night and day temperatures approximated 60°-70°F than at 40°-50°F, 50°-60°F, and 70°-80°F.

The staining of celery petioles with 2,3,5,-triphenyltetrazoliumchloride was not useful in differentiating the various stages of pithiness development.

One year's data showed that Utah had a significantly smaller cell size than Summer Pascal and Emerson Pascal. This suggests that small cell size may be associated with resistance to pithiness and may be useful as an index for selection of plants resistant to pithiness.

Microfilm $2.00; Xerox $6.00. 121 pages.

GAMMA PHENOXYBUTYRIC COMPOUNDS AND OTHER HERBICIDES ON LEGUMES

(L. C. Card No. Mic 59-372)

Clyde Cecil Dowler, Ph.D.
The Ohio State University, 1958

Experiments were conducted in 1956, 1957, and 1958 to determine the usefulness of gamma phenoxybutyric compounds and other herbicides for controlling weeds in alfalfa, red clover, birdsfoot trefoil and sweetclover.

Pre-emergence applications of all phenoxy herbicides resulted in poor weed control or severe injury to the legumes. Ethyl-N,N-di-n-propylthiolcarbamate (EPTC) at three pounds per acre or above gave excellent control of grasses and fair control of lambsquarters (Chenopodium album) and pigweed (Amaranthus retroflexus) without injuring alfalfa or birdsfoot trefoil. A significant increase in the yield of summer seeded alfalfa was obtained following pre-emergence applications of EPTC at four and six pounds per acre.

Post-emergence applications of EPTC gave poor weed control. In general, early post-emergence treatments of gamma(2,4-dichlorophenoxy)butyric acid [4-(2,4-DB)] and gamma(2-methyl, 4-chlorophenoxy)butyric acid [4-(MCPB)] at one pound per acre or more resulted in good to excellent control of lambsquarters, pigweed and wild mustard (Brassica kaber).

The phenoxybutyric compounds had a much greater margin of safety on legumes than the phenoxyacetic compounds. One pound per acre of 4-(2,4-DB) and 4-(MCPB) caused little or no injury to small seeded legumes. One-fourth pound per acre of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2-methyl,4-chlorophenoxyacetic acid (MCPA) did not cause serious injury to alfalfa or birdsfoot trefoil. However, these rates in general did not satisfactorily control broadleaf weeds. Post-emergence applications of 4-(2,4-DB) were less injurious to alfalfa and birdsfoot trefoil than 4-(MCPB). These compounds were equally toxic to red clover.

Pre-and post-emergence treatments of 3-(3,4-dichlorophenyl)-1-methyl-1-n-butylurea (neburon) did not harm alfalfa and birdsfoot trefoil. At two and four pounds per acre, neburon gave satisfactory to excellent control of lambsquarters, pigweed and wild mustard but poor control of ryegrass and German millet.

Post-emergence applications of 4,6-dinitro-ortho-secondary-butylphenol (DNBP) at two and three pounds per acre gave poor grass control and good to excellent control of most broadleaf weeds, with slight injury to alfalfa and birdsfoot trefoil. Rates of DNBP above three pounds per acre severely injured alfalfa and birdsfoot trefoil.

Good to excellent control of German millet was obtained from post-emergence treatments of the sodium salt of 2,2-dichloropropionic acid (dalapon) from one to four pounds per acre. These rates did not seriously injure alfalfa or birdsfoot trefoil.

Combinations of dalapon and the phenoxybutyrics as post-emergence treatments gave fair to excellent control of grasses and broadleaf weeds in alfalfa and birdsfoot trefoil. The combination of Dalapon at two pounds per acre and 4-(2,4-DB) at one pound per acre gave the most satisfactory mixture from the standpoint of weed control and lack of injury to the legume.

In the rosette stage, yellow rocket (Barbarea vulgaris) was completely killed by 2,4-D amine at one-half pound per acre, and alfalfa was severely damaged. The amine of 4-(2,4-DB) gave satisfactory control of yellow rocket at one and two pounds per acre, with only slight injury to the alfalfa. In the early bud stage, 2,4-D at one and two pounds per acre satisfactorily controlled yellow rocket, but killed the alfalfa. Four and eight pounds per acre of 4-(2,4-DB) controlled yellow rocket in the early bud stage and severely injured the alfalfa.

Microfilm $2.00; Xerox $5.40. 110 pages.

EFFECTS OF SUPPLEMENTARY ILLUMINATION ON THE GROWTH OF WINTER SNAPDRAGON (ANTIRRHINUM MAJUS L.)

(L. C. Card No. Mic 59-446)

Harrison Leigh Flint, Ph.D.
Cornell University, 1958

These investigations with snapdragons were conducted to determine the value of supplementary light for partially offsetting the effects of the short, predominantly cloudy winter days in northern areas of this country.

Snapdragon seedlings of two varieties, Jackpot and Margaret, were lighted with incandescent and mercury vapor lamps. Several methods of lighting were used. Part of the seedlings used were grown to a single stem; the remaining seedlings were pinched (growing point removed) to allow the growth of more than one stem on a plant. To determine the relative effects of light duration and intensity, growth chamber studies were also carried out.

The two varieties exhibited a quantitative, but not a qualitative, difference in response. The single-stem method of culture was found to be best adapted to supplementary lighting.

Earliest flowering was induced through the use of incandescent lamps. A considerable advance in flowering was obtained by using mercury lamps, with less decrease in size than was observed when incandescent lamps were used.

A point was found beyond which transplanting into the greenhouse bench was more beneficial than remaining in clay $2\frac{1}{4}$ inch pots for the sake of additional lighting.

The efficiency of utilization of natural and artificially

applied light was estimated. The artificial light was used with about twice the efficiency of the natural light.

Through the use of a light break in the middle of the night, it was found that the snapdragon did not exhibit a true photoperiodic response. There was, however, some indication in the growth chamber experiments that a critical photoperiod may exist at 77°F.

Growth chamber experiments showed that longer light durations were more effective in producing dry matter in small seedlings than shorter durations, even when light saturation of photosynthesis was shown not to be operating. The durations used were six, 12, and 24 hours daily.

It was concluded that supplementary lighting can be used to economic advantage for commercial snapdragons. Different methods can be used to accomplish the different intermediates between an extremely large product and an extremely early one. This will be of value only when additional varieties are screened for response, and when lighting methods are incorporated into revisions of current production schedules.

Microfilm $2.00; Xerox $6.60. 140 pages.

THE INHERITANCE OF FUSARIUM RESISTANCE IN MUSKMELONS

(L. C. Card No. Mic 59-132)

John Alan Mortensen, Ph.D.
Cornell University, 1958

Control of Fusarium wilt of muskmelons is practically limited to the breeding of varieties which are resistant to the pathogen. Though several resistant varieties have already been developed, the inheritance of resistance has not been determined completely heretofore.

One of the principal problems in a study of the inheritance of Fusarium resistance is to find suitable conditions for testing the plants for resistance. A study was therefore undertaken involving methods of inoculation, age of the plant at the time of inoculation, and effects of temperature and season of the year on testing for resistance. The aim was to find some reliable method of testing for resistance in the greenhouse, a method which would cause complete killing of susceptible varieties while leaving resistant varieties healthy.

Killing of some of the resistant plants occurred where the melons were seeded directly into infested soil or were grown in non-infested soil and transplanted bare-rooted to infested soil. The problem was solved by growing the plants in $2\frac{1}{2}$-inch pots of non-infested soil and transplanting to infested soil with the soil ball intact, rather than bare-rooted.

In some instances, plants which were older at the time of inoculation were more resistant than plants which were younger. In other instances there was no correlation between age and expression of resistance.

Fusarium wilt is markedly affected by temperature. In muskmelons the disease is inhibited by hot summer temperatures, unlike the same disease in watermelons which flourishes at high temperatures. A constant soil temperature of 30° C. appeared to be better than 16° C. for testing melons for resistance. At the lower temperature many resistant plants were killed. During hot summer weather there was incomplete infection of susceptible varieties, and during midwinter there was partial killing of resistant varieties, but during the spring and during late August and September the testing was more reliable.

Two greenhouse methods of inoculation proved to be superior to other methods tested. They were the layer method (placing 10 to 15 grams of wheat inoculum beneath each plant at the time of transplanting), and the injection method (injecting the stem of each plant with a hypodermic needle containing a concentrated spore suspension of Fusarium).

Inheritance studies were made in the field and in the greenhouse, testing F_1's, F_2's, and backcrosses from crosses between different resistant and susceptible varieties of muskmelon. Resistance was dominant to susceptibility in all crosses. Some crosses segregated with monohybrid ratios of 3:1 in F_2 and 1:1 in backcrosses to susceptible parents, and others with dihybrid ratios of 9 resistant to 7 susceptible in F_2 and 1 resistant to 3 susceptible in backcrosses.

Data on inheritance are not as yet conclusive, but the hypothesis of a principal dominant gene plus two complementary dominant genes fits all the data and offers an explanation of apparent inconsistencies in the data of previous investigators. Under this hypothesis the complementary genes, A and B, produce a resistant phenotype in the absence of the principal dominant gene, R. The legend according to this hypothesis would be as follows:

R_ A_ B_	Resistant
R_ A_ bb	Resistant
R_ aa B_	Resistant
R_ aa bb	Resistant
rr A_ B_	Resistant
rr A_ bb	Susceptible
rr aa B_	Susceptible
rr aa bb	Susceptible

Microfilm $2.00; Xerox $5.00. 99 pages.

EFFECTS OF PARAFFIN WAXES ON GROWTH AND PHYSIOLOGY OF ROSE PLANTS

(L. C. Card No. Mic 59-1149)

St. Joseph Toy, Ph.D.
Iowa State College, 1958

Supervisors: Frederick G. Smith and E. S. Haber

Although it has been a practice of nurserymen for more than twenty-five years to protect the canes of dormant rose plants by dipping in melted paraffin wax, the effects of the process have not been critically investigated. A field experiment was carried out in the 1957 growing season using 270 rose plants of the hybrid tea variety Crimson Glory. Treatment included National Wax Company's (Chicago, Illinois) Cream Rosebush Wax and Light Green Rosebush Wax, and an untreated control. Three planting dates were used, which made nine wax by date treatment combinations. A randomized complete block design with six replicates was used. Measurements included: dates of flowering, numbers of flowers, per cent of original cane length surviving, number of new shoots, total length of new growth, weight of roots, number of new roots, number of

plants surviving over winter, and number of flowers the second spring. Response of the waxed plants, all measurements considered, was about 50 per cent greater than the untreated. There was no significant difference between the two waxes and response was reduced as planting was delayed.

Prior to planting in the field, the waxed plants showed more shoot and root growth than those which were untreated. To evaluate this more precisely, a controlled humidity storage experiment was set up in the spring of 1958 using relative humidities of 100, 75, and 50 per cent. Temperatures were maintained between 45° and 60°F simultaneously for all humidities. Treatments included plants which were waxed, dipped in hot water the same temperature as the wax, and untreated. The hot water treatment was used to determine the effects of waxing temperatures. Ten plants were used for each of the nine treatment combinations and the experiment was analyzed statistically as a completely randomized design. Data were taken on shoot growth, root growth, mold, dieback, and per cent moisture in canes. Results showed that there was significantly more shoot and root growth on the waxed plants at all humidities, mold development was greater at the higher humidities, dieback was greater in the hot water treated plants and at the lower humidities, and moisture contents of canes were slightly less at the lower humidities, except for the waxed plants.

In order to investigate the effect of paraffin wax as a moisture barrier an experiment making use of stem sections of althea, privet and rose was carried out. Results showed that all unwaxed stems lost substantially all their moisture within four days. If the stem ends were waxed, moisture loss was reduced in althea and privet but not in rose. When entire stem sections were waxed, moisture loss was considerably retarded although it still remained the most rapid in the rose.

Measurements of respiration were made on variously treated cane sections of rose. Waxing reduced respiration about 25 per cent compared with the untreated canes. Waxing the canes, followed by removal of the wax resulted in a higher respiration rate than for the untreated. Hot water treatment at temperatures of 158° to 180°F increased the respiration rate, but the same treatment above 185°F reduced respiration.

An anatomical study of treated rose canes indicated that waxing up to 190°F had no visible effect on any tissue. Dipping in hot water at the same temperature, however, did cause collapse of epidermal, cortical and phloem cells although the cuticle did not appear to be affected. No indications of wax penetration were observed.

Microfilm $2.00; Xerox $5.80. 120 pages.

THE MORPHOLOGY OF SEBACEOUS TYPE GLANDS OF THE RAT AS INFLUENCED BY CERTAIN HORMONAL FACTORS

(L. C. Card No. Mic 59-150)

William Paxton Callahan, III, Ph.D.
The University of Texas, 1958

Supervisor: Raymond F. Blount

The factors controlling the size and functional state of sebaceous glands are not well understood. Certain hormones exert definite and specific effects. Testosterone and progesterone have been shown to cause an increase in gland size in the normal animal, but, following hypophysectomy the degree of response is greatly reduced. This and other evidence has led some workers to investigate more thoroughly the role of the pituitary gland.

The problem has been approached in the present investigation by observations on the preputial and Harderian glands, as well as the sebaceous glands of the albino rat, since all three are reported to be similar in type. Data are also reported for hair, as an integral part of the pilosebaceous unit. Weight data and histologic observations are presented on the preputial and Harderian glands. Sebaceous glands have been studied by observations of sectioned material and more extensively by whole-mount preparations in which the sebaceous material is stained by oil-Blue-N.

Data were obtained by these methods for animals from which various endocrine glands had been removed; with particular attention being given the effects resulting from hypophysectomy. Animals subjected to the latter operation were used as basal animals, and the effects of hormone replacement were determined, both singly and in combinations. Modifications of the sebaceous type glands brought about by altered endogenous pituitary hormones were studied in animals bearing pituitary grafts.

The trophic action of the gonadal hormones, progesterone and testosterone, on sebaceous glands is reconfirmed, the latter being far more potent. The action appears to be a direct one since stimulation is noted in hypophysectomized, as well as intact animals.

Adrenalectomy of several weeks duration in the male brings about an hypertrophy of the sebaceous glands and an overgrowth of hair, but an atrophy of the preputial glands. From these responses it seems perfectly clear that the adrenal has some role in regulating the normal growth of these structures.

The possibility that the pituitary also produces a substance trophic in action is suggested by the observation that hypophysectomy leads to an atrophy greater than that produced by the removal of any other endocrine gland. Further evidence is provided by the finding of a degree of maintenance of sebaceous and preputial glands in hypophysectomized animals bearing pituitary transplants. In addition to providing sebaceous stimulation it was noted that pituitary transplants in young animals induced the development of a pelage which more closely resembled that of the normal adult, than that of the hypophysectomized animal.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Both of the above effects were considered to be due to continued luteotrophin secretion by the transplanted pituitary. Injection of commercial preparations of purified luteotrophin brought about stimulation of the sebaceous, preputial, and Harderian glands, and also gave rise to a coarsening of hair in hypophysectomized rats. Since hypophysectomy brings about atrophy of all three glands, and prevents hair maturation, and since relatively normal growth and maturation are observed when either endogenous or exogenous luteotrophin is present in the hypophysectomized animal, it is felt that this hormone is one, if not the only agent produced by the pituitary which is trophic to these structures.

Microfilm $2.45; Xerox $8.40. 185 pages.

THE CLAVICLE AND SCAPULA OF THE NEWBORN INFANT

(L. C. Card No. Mic 59-364)

Gilbert Edward Corrigan, Ph.D.
The Ohio State University, 1958

The study of a series of seventy neonate clavicles and sixty neonate scapulae has established the osteological and radiographic characteristics of the clavicle and scapula at birth. Comparisons of the measurements obtained were made with those of both the fetal and adult state. The gross anatomical relationships were described for each bone, and comparisons were made with the adult.

A longitudinal concept of the oesteogenesis of the clavicle is presented, in which the conservative nature of the bone to functional change is shown by the retention of similar osteometric indices throughout the latter half of fetal existence and later post-natal periods. By a comparison with the fetal growth of the bi-acromial diameter, the growth of the clavicle is shown to bear a linear relationship with the crown-heel length. The role of the clavicle as a stabilizer of the shoulder girdle in the alternating bipedal gait is discussed.

The growth of the scapular indices and measurements are found to parallel those of the clavicle and to bear a constant relationship to crown-rump length and the bi-acromial diameter of the neonate. The retention of the cartilaginous borders and angles of the scapula allows the discernment of the classic scapular types at the neonate stage.

Neither the scapula nor the clavicle shows significant bilateral asymmetry, racial or sexual differences.

Microfilm $2.75; Xerox $9.40. 210 pages.

ANTHROPOLOGY

LEADERSHIP AND CULTURAL CHANGE IN PALAU

(L. C. Card No. Mic 59-265)

Roland Wynfield Force, Ph.D.
Stanford University, 1958

The study deals with leadership and cultural change in the Palau Islands of Micronesia. Its focus is on leadership phenomena in a situation of cultural change wherein alien concepts of leadership have been and are being introduced by a superordinate culture to a subordinate one. The principal emphasis centers on the interconnection of leadership and cultural change. Within this area of emphasis are considered the natures of both traditional and emergent leadership in Palau, the changes from traditional modes and patterns of leadership to new and emergent ones, the effect of cultural change on traditional leadership behavior and status, and the conflicts engendered by conditions of cultural change.

The field research upon which the study is based was conducted from December 1954 to April 1956 under the auspices of the Tri-Institutional Pacific Program (Yale University, Bernice P. Bishop Museum, and the University of Hawaii, participating institutions). Financial support was provided by the Carnegie Corporation of New York. Two communities which represented the greatest degree of contrast possible within present-day Palauan culture were studied. One community represented maximum change from traditional culture while the other represented minimal change. The selection of each community was based upon its contact history, the relative presence or absence of newly introduced agencies of political power, and ecological and demographic factors within the community. The major methodological approach employed was that of participant-observation.

At the outset of the study the Palau Islands and their people are described briefly so as to provide an idea of the setting in which the investigation was conducted. The traditional context of leadership then is examined in terms of territorial and political alignments, village organization, age-grading, and kin group organization. Hereditary, supernatural, and age and respect sanctions for leadership are described and comparisons are made when possible between normative and actual behavior. The first contacts between Palauans and early European voyagers are noted along with the history of the islands under Spanish, German, Japanese, and American administrations. Stimuli for cultural change in Palau, especially in terms of changes in the modes and patterns of traditional Palauan leadership, are examined.

In the final chapters of the study the Palauan data are examined in terms of certain general understandings about cultural change theory to determine in what ways they offer substantiation, extension, or contradiction. Finally, the case data of this study of leadership change under acculturative stress are compared with the findings of other recent studies of leadership in areas which have had a history of contact and administrative background broadly comparable to that of Palau.

The nature of emergent leadership and its development is viewed as either a by-product or as a direct result of the policies and practices of foreign governing powers. Especially emphasized in later sections of the study is the emergence and development of local representative self-government in Palau according to patterns derived from the Western World. The new agencies of political power which are emerging under programatic directed cultural change are contrasted with the existing traditional leadership and the old agencies of power.

Although vastly weakened, traditional leadership co-exists with emergent leadership in contemporary Palau. Sanctions for power are dual and traditional and embryonic new agencies are rivals. Symbols of prestige and status, modes of leader selection, and canons of respect are likewise competitively dichotomized. Dysfunction is a primary consequence of the current dual system of leadership in Palau and there are implications that the situation will remain so for some time to come.

Microfilm $4.00; Xerox $13.60. 312 pages.

THE MORPHOLOGICAL ASPECTS OF THE SKULL IN MONGOLISM

(L. C. Card No. Mic 58-7929)

Louanna Pettay, Ph.D.
Indiana University, 1958

Problem. A comparison was made between the head dimensions and proportions of males with mongolism and normal age-constant standards to determine: (1) which dimensions and/or proportions of the mongoloid skull showed the most severe retardation and (2) if these differences could be related to a pathologic alteration in a specific area of the skull, or a pathologic alteration in a specific mechanism of skeletal growth (e.g., bone apposition, or cartilagenous growth).

Procedure. The mongoloid series was composed of 25 adult males and 27 boys. The following dimensions of the mongoloid skull, length, breadth, circumference, auricular height, minimum frontal diameter, bizygomatic diameter, bigonial diameter, upper facial height, total facial height, and nasal height, were compared to a normal group. Comparison was effected by converting the mean differences between the mongoloid and normal series into standard scores.

Comparison was also made (using lateral X-rays) of the spatial orientation of the bones of the cranial vault and the curvature of the frontal and parietal bones between the mongoloid and normal series.

Results. A statistically significant difference was found to exist between the mongoloid and the normal in all measured head dimensions. However, the severity of retardation was not the same in all dimensions. Those most markedly retarded were: length and total and upper facial height. Least retarded were head breadth and bigonial diameter. The latter two dimensions were regarded as small but not abnormal. The remaining five dimensions occupied an intermediate position; their standard scores ranged from 1.6 to 2.76.

The X-ray analysis revealed a reduction in the bregma angle and an increase in the nasal and lambda angles of the nasion-bregma-lambda triangle. This reduction was related to an overall reduction in the length of the mongoloid skull rather than to alteration in the proportion of the anterior or posterior part of the brain case. The X-ray analysis also showed an increased curvature (measured by the curvature height index) in the frontal and parietal bones.

Conclusions. It was concluded that the size and shape of the mongoloid skull was the result of an overall retardation in skeletal growth and that the alterations observed could not be related to any characteristic pathologic alteration in a specific site. There was no evidence to support the theory that growth retardation in the cranial base is responsible for the size and shape of the mongoloid cranium. The differences in the severity of retardation in various dimensions was interpreted as being the result of local supervening factors.

Microfilm $2.00; Xerox $5.80. 117 pages.

BACTERIOLOGY

A GENETIC STUDY OF A LARGE CELL STRAIN OF ESCHERICHIA COLI

(L. C. Card No. Mic 59-114)

Renee Rafaela Alexander, Ph.D.
Cornell University, 1958

The large cell strain of Escherichia coli P6 was isolated from a culture of E. coli 82/r following exposure to camphor vapors. The large cell size of this strain was correlated with the coarse granular morphology of its colonies when viewed under oblique illumination. The P6 strain is also characterized by a threefold increase in cell content of deoxyribonucleic acid, ribonucleic acid and dry weight. Comparative studies of the resistance to radiation of strains P6 and 82/r revealed that P6 was markedly more resistant to x-rays, gamma-rays and ultraviolet light. In addition 82/r exhibited exponential survival whereas P6 yielded sigmoidal survival curves following exposure to x-rays and gamma-rays. These results provide indirect evidence that P6 is a polyploid derivative of 82/r. However, in genetic recombination experiments, segregation of radiation resistance together with cell size was influenced by F polarity in the same manner as the unselected markers in general in E. coli and comparative mutation studies toward phage and drug resistance failed to show any differences in mutation rates between the two strains. Hence it was postulated that P6 could have originated

by a mutation which caused an increase in the average number of nuclei per cell. These investigations were conducted by M. R. Zelle and J. E. Ogg in this laboratory and led to the present study which was undertaken to elucidate further the genetic nature of P6.

To this end three aspects relating to P6 were investigated: (1) genetic recombination experiments, (2) estimations of average number of nuclei by analysis of lactose negative mutants sectoring patterns and (3) a study of mutation-dose relationships of lactose negative and granularity mutants. The genetic recombination studies were aimed at comparing P6 and 82/r with respect to segregation patterns. Rates of prototroph formation were equal for the two strains. If P6 were a diploid or polyploid, crosses between lactose negative auxotrophic mutants of P6 with a haploid, lactose positive nutritionally deficient mate should yield prototrophs heterozygous for the lactose fermentation gene. Upon forcing these prototrophs into a second generation together with a lactose positive haploid strain, segregation of lactose negative strains would be expected. Such segregants were recovered but also and equally as frequently in the crosses involving 82/r. Lactose positive back mutants of P6 and 82/r were then crossed with the lactose positive haploid mate. This experiment should result in the segregation of recessive genes in the first generation. Lactose negative prototrophs were again recovered from both crosses. Such evidence suggests that both P6 and 82/r are diploid or polyploid.

Estimations of nuclear numbers by analysis of the sectoring patterns of lactose negative mutants revealed that P6 contains about twice as many nuclei per cell as its parent strain 82/r. The lactose fermentation mutation studies resulted in the discovery of granular colonies of large cell size which were recovered in approximately the same proportions as the lactose negative mutants. The granularity mutants resemble P6 in cell size, granularity and ultraviolet absorption. From the previous investigations and the data obtained in the present study, it is tentatively concluded that both P6 and 82/r are diploid or polyploid and that P6 is the result of a gene mutation in 82/r. Such a mutation could cause some interference in the cell division process resulting in an increase in the mean number of nuclei which would be reflected by increases in DNA, RNA and dry weight contents per cell as well as increases in resistance to radiations.

Microfilm $2.00; Xerox $6.20. 128 pages.

STUDIES OF THE CHOLERA VIBRIO

(L. C. Card No. Mic 59-158)

Earl William Gardner, Jr., Ph.D.
The University of Texas, 1958

Supervisor: Dr. Orville Wyss

Studies have been conducted using different strains of Vibrio cholerae. The investigation has been directed toward furthering the knowledge of the nutritional, antigenic, and genetic characteristics of the organism.

The nutritional study was concerned with the effect of heat sterilization of amino acids in a chemically defined medium. Certain unidentified products of interaction of tyrosine, tryptophane, and alanine with constituents of the culture medium were observed to cause an extension of the lag or a possible bactericidal effect. DL-tyrosine and DL-tryptophane were found to cause a marked delay in growth when they were autoclaved in the basal medium, but they were comparatively non-inhibitory when autoclaved separately or filter sterilized. The effect was greatest at high concentrations of the amino acids (250 to 1000 μg per ml). Tests with the various components of the basal medium indicated that phosphate and other minerals were intimately involved in the generation of toxicity.

Tests with different isomers indicated that the order of decreasing activity of the isomers of alanine was DL-L-D. Approximately equal inhibitory activity was generated from DL and L-tyrosine. The order of decreasing inhibitory activity for tryptophane was D-DL-L. Isomers of glutamic acid were found to be stimulatory under all conditions of sterilization while glycine was inhibitory regardless of the method used for its sterilization. The toxic effect resulting from the heat sterilization of DL-tryptophane in the medium was completely counteracted by peptone and casein hydrolysate in concentrations as low as 10 μg per ml. It would seem that the observed inhibition would be of significance in chemically defined media only.

The antigenic studies were slanted toward elucidation of the position of the Rho form in relation to the other types. During the course of the study, a standard method for selecting and maintaining antigenic types by means of serum soft-agar was developed.

Attempts were made to devise an in vitro selective means for enhancing the development of S variants from predominantly R populations. The results obtained with a non-specific DNA + DNase system indicated that the presence of a few S cells was required to initiate population changes toward S. This in turn suggested that the breakdown product responsible for these effects did not result directly from the depolymerization of DNA by DNase. Attempts to use kinetin to bring about R to S population changes were not successful, but an enhancement of the Rho form by this means suggested that the Rho might be an intermediate in the direction toward the S or virulent form.

Agglutination and absorption tests were carried out using typical S, R, and Rho forms. The results of this investigation indicated that the S form possessed the S, R, and Rho antigens; that the R form possessed the R and Rho antigens; and that the Rho form possessed chiefly the Rho antigen with R present as a minor component. Variation studies with the Rho form indicated that it tended to revert most readily to forms which were different from the standard antigenic types.

A study was conducted to point out the effect of antigen treatment upon subsequent serologic response. Regardless of antigenic type, cells grown on minimal medium and heat treated exhibited the maximum expression of detectable antigenic components.

An attempt was made to bring about genetic transformation using purified DNA. In the case of one strain, an apparent transformation of the characteristic of streptomycin-resistance was observed. However, the fact that the frequency of the change was not of the order which is usually associated with transformation reactions indicated that optimum conditions for demonstration of the phenomenon were not in force. Microfilm $2.30; Xerox $8.00. 174 pages.

STUDIES ON CANINE PLEUROPNEUMONIA-LIKE ORGANISMS

(L. C. Card No. Mic 59-124)

Richard Ralph Gutekunst, Ph.D.
Cornell University, 1958

An organism of unusual morphology, now designated Asterococcus mycoides, was isolated by Nocard and Roux in 1898 who found it to be the causative agent of a pleuropneumonia in cattle. This organism was characterized by a highly polymorphic structure, an ability to pass through filters which retained ordinary bacteria, and extreme fastidiousness when grown artificially. Organisms resembling the description of Asterococcus mycoides have been isolated from sources other than cattle (mice, rats, guinea pigs, pigs, chickens, turkeys, parakeets, dogs, and man) and have been designated pleuropneumonia-like organisms (PPLO). Shoetensack (1934) obtained on solid culture medium a pure culture of PPLO from nasal secretions and lung and liver suspensions of dogs which showed a typical respiratory form of distemper.

During the study presented here, 58 attempts to isolate PPLO were made on 35 dogs with respiratory illness and on 25 dogs with no respiratory disease. Fifty-two strains of PPLO were recovered from the first group of dogs. Twenty-six isolations were made from the nasal passages of 27 dogs diagnosed as having distemper. Ten vaginal swabs, three urethral swabs, and two lung homogenates from distemper dogs were also positive for PPLO. One dog suffering from atypical distemper and 10 that demonstrated signs of tracheitis were found to harbor PPLO in their nasal passages. Only six positive isolations of PPLO were made from 25 dogs which had no signs of illness referable to the respiratory tract.

Growth of 46 of these strains on artificial media resulted in the formation of five distinct colonial types. Four strains, representative of two colonial types, were analyzed serologically and all strains appeared closely related. Strain 4 possessed greater immunogenic properties.

Twelve strains of PPLO isolated during this study were capable of producing a soluble hemolysin. This hemolysin was heat and oxygen stable and was specific for dog erythrocytes. No hemolytic activity was noted in the presence of bovine, chicken, rabbit, and sheep red blood cells. Sera from hyperimmune rabbits and from normal rabbits, dogs, sheep, and calves inhibited the hemolytic activity. The degree of hemolytic inhibition by these sera varied with the strain of antigen employed.

Pathogenicity for mice was established with 14 strains of canine PPLO but attempts to produce disease in 21 disease-free beagle puppies following either intranasal instillations, intratracheal inoculations or aerosol exposure were not successful except in one instance in which the dog was chilled after inoculation. Combined inoculations of either virulent or avirulent distemper virus and PPLO did not increase the severity of the disease. Twenty of the 21 dogs exposed to PPLO demonstrated agglutinins in their sera within 14 days after inoculation.

The frequent occurrence of PPLO in natural disease indicates a pathogenic role, but factors other than those tested in this study should be sought which might be necessary to produce experimental infection in dogs.

Microfilm $2.00; Xerox $3.00. 52 pages.

MECHANISM OF ACQUIRED IMMUNITY IN TUBERCULOSIS

(L. C. Card No. Mic 59-273)

Ivan Kochan, Ph.D.
Stanford University, 1958

Certain cellular and humoral aspects of acquired immunity in tuberculosis were investigated in this research. The cellular aspect was pursued with the aid of macrophages collected from peritoneal cavities of immune and tuberculin-negative guinea pigs. The tissue cultures of these phagocytic cells were infected with virulent tubercle bacilli (H37Rv strain) and the bacillary growth was estimated at various time intervals by plating, Youmans growth-tube culture method, and microscopic smear evaluations. The humoral aspect was investigated using sera obtained from infected, BCG-vaccinated, and tuberculin-negative guinea pigs. The sera, usually 1:2 dilution in Hanks solution, were inoculated with tuberclebacilli and bacillary multiplication was estimated by plating, cellular nitrogen, and microscopic smear evaluations.

Results obtained in the tissue culture studies with macrophages indicated that phagocytic cells have no special ability to destroy tubercle bacilli, at least under in vitro conditions. The total number of viable tubercle bacilli in Porter flasks containing cells from either immune or normal sources increased more rapidly at first than in Hanks serum alone. In a few days, however, the total count of bacilli generally was higher in Hanks serum alone than in macrophage cultures. No particular difference was noted in cultures of macrophages from normal or immune animals. These results, therefore, could not be interpreted in favor of the concept which proposes that phagocytic cells constitute a specific immune defense mechanism in tuberculosis.

A strong bacteriostatic effect against tubercle bacilli was detected in sera collected from infected and BCG-vaccinated animals. In the first case, this effect was present during the disease period, but in the latter case this effect was limited in time and was present only for 2.5 to 3 months after vaccination. Investigation of the inhibitory factor revealed the following features:

1. It is heat stable at 60° C. for one hour but progressively loses its activity at 65° C. and over.
2. It does not require complement for its activity.
3. It cannot be adsorbed by methods employed for adsorption of an antibody.
4. Dialysis against physiological saline inactivates the bacteriostatic factor but not when this is done against Hanks solution. There are reasons to believe that the inhibition depends on the presence of calcium ions which are lost when the serum is dialyzed against physiological saline.
5. Citrate has an antagonistic action for the inhibitory factor.
6. An attempt to transfer this inhibitory activity passively from immune to normal animals failed in this laboratory.

Microfilm $2.00; Xerox $6.80. 144 pages.

FIXATION OF CARBON DIOXIDE BY CHEMOAUTOTROPHIC BACTERIA

(L. C. Card No. Mic 59-1147)

Isamu Suzuki, Ph.D.
Iowa State College, 1958

Supervisor: C. H. Werkman

The metabolism of Thiobacillus thiooxidans, mainly its carbon dioxide fixation, was studied using both whole cells and cell-free preparations. The whole cells oxidizing sulfur incorporated the radioactivity of $C^{14}O_2$ most rapidly into the carboxyl group of phosphoglyceric acid and the β-carboxyl group of aspartic acid. The radioactivity also appeared in glucose phosphates, sugars, organic acids, amino acids, and peptides. The cell-free extract of T. thiooxidans was shown to have at least two carboxylation systems, i.e., the carboxylation of ribulose diphosphate to form phosphoglyceric acid and the carboxylation of phosphoenolpyruvic acid to form oxalacetic acid. Evidence is given for the presence of following enzymes in the extract: phosphoenolpyruvic carboxylase, oxalacetic carboxylase, phosphoriboisomerase, phosphoribulokinase, carboxylation enzyme, 3-phosphoglycerokinase, glyceraldehyde-3-phosphate dehydrogenase, triosephosphate isomerase, and aldolase. The presence of transketolase, transaldolase, and phosphoketopentoepimerase is also indicated.

It is concluded that T. thiooxidans can synthesize carbohydrate from carbon dioxide by a cyclic mechanism similar to that of photosynthesis. Phosphoenolpyruvic carboxylase is apparently important for the synthesis of some amino acids from carbon dioxide.

The Michaelis constant of phosphoenolpyruvic carboxylase for HCO_3^- was determined as 1.2×10^{-3}M. The pH optima of phosphoriboisomerase and aldolase were determined to be near 7 and 9, respectively.

The metabolism of glucose by the organism was studied using uniformly labeled glucose as well as glucose-1-C^{14}. The presence of the hexose monophosphate pathway is suggested.

Transamination between aspartic acid and α-ketoglutaric acid was observed in the whole cells and the cell-free extract.

Elemental sulfur was oxidized by the extract only in the presence of reduced glutathione. Thiosulfate and polythionate were formed in the oxidation. The extract contained a reduced triphosphopyridine nucleotide-dependent glutathione reductase. Sulfide was oxidized by the extract to elemental sulfur and thiosulfate. Ethylenediamine tetraacetate enhanced the rate of oxidation.

A heat-labile adenylate kinase was present in the extract. Microfilm $2.00; Xerox $6.40. 135 pages.

A STUDY OF GLUCOSE-PHOSPHATE IN THE GROWTH INITIATION OF BACILLUS GLOBIGII

(L. C. Card No. Mic 59-184)

Richard Warwick Traxler, Ph.D.
The University of Texas, 1958

Supervisor: V. T. Schuhardt

Earlier observations on the effect of inoculum size and the concentration of the glucose-phosphate (GP) factor on the growth initiation of Bacillus globigii have been confirmed. The fact that large inocula initiated growth as promptly in the absence of the GP factor as in its presence was taken as preliminary evidence for the production by the cells of an endogenous factor similar in action to the GP factor. The addition of biotin and nicotinic acid to the growth medium increased the sensitivity of the assay but did not change the specificity of the response to the GP factor. Investigation of the relation of manganese, magnesium and iron to the GP factor response demonstrated that only manganese was directly related to the action of the factor. The active factor has been concentrated 700 fold by adsorption on norite A, elution with a mixture of warm 66 per cent acetone and 5 per cent ammonia, and extraction of this eluate with ethyl acetate. The results from column chromatography, electrophoresis and bioautographs of this concentrate indicated the presence of at least two active factors or two forms of the active material. Evidence was obtained for an OH group and possibly a carboxyl or other acidic group in the active material. Experiments with vegetative cell preparations have shown a stimulation of cellular pyrophosphatase activity by the GP factor and manganese. Other metal ions were shown to be effective to some extent in the activation of the pyrophosphatase activity, but manganese showed the highest activity and appeared to be the most specific. A study of the pH relation to the manganese activation of pyrophosphatase activity indicated the possibility of two different vegetative cell pyrophosphatases.

Microfilm $2.00; Xerox $5.80. 120 pages.

BIOGRAPHY

ELKANAH WATSON: GENTLEMAN - PROMOTOR, 1758 - 1842

(L. C. Card No. Mic 59-732)

Hugh Meredith Flick, Ph.D.
Columbia University, 1947

Elkanah Watson was born in Plymouth, Massachusetts, January 22, 1758 and died at Port Kent, New York on Lake Champlain December 5, 1842. At the age of 15 he was apprenticed to the mercantile firm of John Brown in Providence, Rhode Island. His first important assignment came in the Fall of 1777, when he was commissioned to carry $50,000 in negotiable securities from Providence to Charleston, South Carolina. Throughout this journey, which was made at the height of the American Revolution, Watson kept a careful record of all that he saw and all that he experienced. This journal contains observations on the social, cultural and economic conditions of the Colonies. His insatiable curiosity led him to record the thoughts and observations of those he met on the journey. This was the first of many journals and many journeys.

At the age of 21, Watson was released from his apprenticeship. He continued his mercantile interests, but changed his base from the American Colonies to Europe. During the next five years, Watson gained and lost a fortune. He returned to America in 1784 with a trunk full of journals, a portrait painted by John Singleton Copley, a host of debts and a wealth of experience.

After travelling in all the states of the Union, he finally settled in Albany, New York. For the next half century, his principal passion was the promotion of public improvements; canals, banks, agricultural societies, steamboats, railroads and even a balloon freight line were among his many interests. He made friends and enemies with equal facility. He carried on an extensive, world-wide correspondence and maintained a steady barrage of letters to the editors of the local papers. Perhaps the very complexity and span of his interests was such that his pioneering contributions have been all but forgotten. Few men, however, have labored with more unselfish zeal for the interests and improvement of their country.

The principal interest in Elkanah Watson may be found in his reporting activities. His journals are filled with maps, observations, clippings and speculations. He was a good reporter, and his journals, correspondence and Common Place Book are better source materials on those with whom he had contact than they are on the life of the author. He was a promoter without profit and a prophet without recognition. Microfilm $4.65; Xerox $15.60. 363 pages.

BIOLOGY — GENETICS

ALLELISM, COMPLEMENTARITY, AND PSEUDOALLELISM AT THE DUMPY LOCUS IN D. MELANOGASTER

(L. C. Card No. Mic 58-7908)

Elof Axel Carlson, Ph.D.
Indiana University, 1958

In the dumpy series of multiple alleles (2, 13.0), three major recessive mutant characters are expressed: a reduction in wing size with terminal truncation of the tips called oblique wings (o); the presence of pigmented pits or mounds on the thorax with associated disturbances of bristles and microchaetae collectively designated as vortex (v); and a pre-pupal lethal effect (l). These three characters can occur in any of eight possible genotypic combinations, of which the seven mutant forms are represented in terms of their functional elements and in their tentatively established map order as follows: 'l 'ol 'olv 'o 'lv 'ov 'v.

The four members connected by a continuous line were directly localized by recombination in the given intervals; members connected by the dotted line represent tentative localization by differences in recombination rates with 'ov for each of those subloci. Since these mutants only manifest the phenotypic elements which are common to their two homologous second chromosomes, expression of both complementary phenotype (e.g. 'o/'lv, 'ol/'v, and 'o/'v are normal) and mutant phenotype (e.g. 'o/'olv is (o); 'ov/'olv is (ov); and 'ol/'lv is lethal) occur in this region. Furthermore, the relation between pseudoallelism and complementarity is not dependent on the linear map distance between subloci within the region, since the trans pair 'o/'lv which is complementary is situated within the region bounded by the trans pair 'olv/'ov which shows a mutant expression, and these in turn are situated within the region bounded by the trans pair 'ol/'v which is complementary.

Similar considerations weaken interpretations based on sequential transfers of precursors from one "subgene" to another and interpretations based on close pairing relations and exchanges of precursors from one homologue to another. The multiplicity of subloci implies that this region is similar to the cistrons found in bacteriophage, but it differs from such units in expressing more than one phenotype and in showing an internal discontinuity for recombinational sites between subloci.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The three phenotypic effects have their embryological expressions at separate times in development, with the lethal prior to the pupal stage, the oblique wings in the 13th to 14th hours of pupal development, and the vortices about the 6th to 10th hours of pupal development. Pleiotropism in this system is a consequence of all three functions being performed by the same cistron, with the particular combination of effects expressed dependent not only on the mutational site altered, but on the type of change at this particular site, since independent mutants of the same sublocus may differ, at least in a quantitative way, from one another.

X-ray analysis of the dumpy region reveals the following: (1) the induced mutation rate is higher for the dumpy series than for any other previously investigated gene (cistron) in Drosophila, (2) the mutational spectrum shows some diversity of frequency for each sublocus, with the 'olv (which, however, would include deficiencies and other multiple mutants) and 'lv types predominating, (3) the majority of both high (4000r) and low (1000r) dose induced mutants are point mutations, (4) the mutational spectra at high and low doses do not differ in their point mutation frequencies at any sublocus, and (5) a large number of these mutations arise from mosaic exceptions when inseminated females are irradiated.

Microfilm $2.00; Xerox $4.20. 77 pages.

STUDIES ON EXPERIMENTAL POPULATIONS OF DROSOPHILA ANANASSAE DERIVED FROM IRRADIATED NATURAL POPULATIONS

(L. C. Card No. Mic 59-160)

Thomas Gilkey Gregg, Ph.D.
The University of Texas, 1958

Supervisor: Professor W. S. Stone

Subpopulations of Drosophila ananassae taken from the populations on various Atols in the Marshall Islands in 1956 and 1957 were maintained in the laboratory in different types of experimental populations. The types of experimental populations are discussed. These subpopulations were derived from populations on the Bikini, Rongerik, and Rongelap Atols which had been exposed to different amounts of radiation from the thermonuclear tests in March, 1954 and from the Majuro Atol which had received very little radiation. The Majuro populations were used as a control. Periodically, the laboratory populations were tested with respect to changes in evolutionary fitness. Evolutionary fitness in the experiments is measured in terms of fertility, viability, and fecundity. Comparisons were made between the changes observed in the different types of experimental populations, between changes in populations that had received different amounts of radiation, and between the experimental populations and the populations remaining on the Islands.

The results are taken as strong evidence that the low viability levels of the 1955 Bikini and Rongelap populations (Stone et al., 1957. Genetic studies of irradiated natural populations of Drosophila. Univ. of Tex. Publ. 5721:261-316.) were actually the result of radiation from the thermonuclear tests 18 months before and not the result of normal population fluctuations. Microfilm $2.00; Xerox $3.00. 39 pages.

GENETIC ANALYSIS OF PERFORMANCE FACTORS IN WHITE LEGHORN PURE STRAINS AND STRAIN CROSSES

(L. C. Card No. Mic 59-1133)

Melvin Lee Hogsett, Ph.D.
Iowa State College, 1958

Supervisor: A. W. Nordskog

The purpose of this investigation was to examine the genetic composition of certain pure Leghorn strains and strain crosses with respect to performance factors. Information from diallel matings was obtained on additive genetic variance and covariance for the two breeding types. Records from a commercial breeding farm consisting of 1829 individuals from four pure strains and 1409 individuals from four strain crosses were analyzed.

The traits studied and their respective heritabilities in the pure strains and strain crosses were body weight at first egg (W), .56 and .54; age at first egg (M), .21 and .38; October egg weight (E_1), .42 and .31; March egg weight (E_2), .49 and .47; percent egg production to December (P_1), .15 and .19; and percent egg production to May (P_2), .09 and .13. These estimates were from the sire and dam combined.

Some of the genetic correlations (sire and dam combined) estimated in the pure strains and strain crosses were, respectively, W x M, +.43 and +.46; W x E_1 + .68 and + .46; W x P_1, -.35 and -.12; M x E_1, -.23 and +.10; M x P_1, -.27, +.03; E_1 x P_1, -.34 and -.15. Correlations between E_1 and E_2 were above +.90 indicating the early measure could be used effectively to select for egg size. The same was true to a lesser extent for P_1 and P_2, the crosses exhibiting a higher correlation than the pure lines.

The traits M, P_1 and P_2 exhibited rather high sire-dam interaction variance components in the pure strains as opposed to the estimates in the strain crosses. This is a measure of dominance variance. Dominance was discussed as a possible explanation for the higher estimates of sire and dam components of variance in the strain crosses.

Genotype-environment interactions of hatch with sire and dams were slightly higher in the pure strains, but were of negligible value in either case. The presence of sex-linked effects was indicated from the larger estimates of sire components of variance and covariance particularly in W, M, and E_1. There was no suggestion that maternal effects were present to any appreciable amount, but the possibility remains that they could be present but overshadowed by sex-linked effects present.

Microfilm $2.00; Xerox $6.40. 131 pages.

STUDIES ON THE NATURE OF GENE-CONTROLLED PROTOPLASMIC INCOMPATIBILITY IN NEUROSPORA CRASSA

(L. C. Card No. Mic 59-290)

James Franklin Wilson, Ph.D.
Stanford University, 1958

Heterocaryosis in Neurospora crassa is known to be controlled, at least in part, by genetic factors. The most thoroughly studied of these factors are the genes C and D

and their alternate alleles, c and d. In strains of the same mating type, previous studies have shown that:

1) Heterocaryosis can occur only if the strains are the same heterocaryon genotype (het^+); if the strains differ in either or both genes, heterocaryosis is prevented (het^-).

2) Hyphal fusion in all het^- combinations is followed by an incompatibility reaction which results in the death of the cells involved.

The object of this investigation was to learn more about the nature of the het^- incompatibility reaction. A micrurgical approach was used, utilizing a DeFonbrune micromanipulator and a microforge constructed from a Taylor micromanipulator.

Transfer of protoplasm between incompatible strains with a micropipette resulted in death of recipient cells in most strains, but injection of compatible protoplasm proved harmless in all cases. Reciprocal transfers between various incompatible pairs revealed marked differences in degree of lethality, ranging from 100% recipient cells killed in every case of two-gene differences, to no recipient cells killed in the combination cd→Cd.

Extracts were prepared from mass cultures and injected into compatible and incompatible cells, and the results paralleled those obtained by injecting protoplasm, except that the extracts were less lethal in certain combinations.

The extracts were subjected to various physical and chemical treatments and tested, using micro-injection as an assay method. Among the treatments employed were differential centrifugation, heat, dialysis, precipitation with acetone, ammonium sulfate, and protamine, digestion with trypsin, ficin, ribonuclease, and deoxyribonuclease.

The results of these and other tests strongly suggest that:

1) Extract activity is associated with both the larger intracellular particulate matter and with the fraction containing microsomes and colloidal material.

2) The activity of the extracts is due to the presence of a protein or proteins, with the possible involvement of deoxyribonucleic acid.

Microfilm $2.00; Xerox $5.20. 105 pages.

THE BIOLOGY OF A SPECIES COMPLEX IN SPIROGYRA

(L. C. Card No. Mic 58-7901)

Marjory Ann Allen, Ph.D.
Indiana University, 1958

A species complex rarely has been studied in the algae due to the difficulties encountered in cultivating the algae and inducing a complete life cycle. The present study stems from observation of variation in filament width in a clonal culture of Spirogyra. The variants, when individually isolated into separate culture vessels, established strains having particular cell widths. The lateral mode of conjugation was characteristic of all variants and the clone was established as being homothallic. Development of methods by which the alga could be maintained in vegetative condition indefinitely or caused to conjugate at will, and methods by which zygospores could be germinated, provided a complete life cycle through which the variations could be followed.

Both light and CO_2 were found necessary for the induction of conjugation, suggesting that conjugation is somehow dependent upon photosynthesis. It was demonstrated that when conditions were limiting for growth, but allowing for photosynthesis, conjugation was likely to proceed. If conditions for conjugation were provided, germlings of two cells or more could be induced to conjugate.

Using cell width as the major criterion each strain represented one of three cell width groups: Width Group I, 15.0-19.5 μ; Width Group II, 21.0-25.5 μ; and Width Group III, 27.0-33.0 μ. Cell width groups were distinguished on the basis of quantitative characters; the qualitative characters were the same in all three width groups. Scalariform conjugation could be demonstrated between cells of different width groups. Filaments of strains representing a particular width group sometimes showed quantitative changes to another width group. Width Group I was the least stable of the groups, filaments frequently undergoing quantitative change to Width Group II filaments. Width Group II filaments less frequently underwent quantitative change to Width Group III filaments. Reversions from Group III and Group II were less common than either of the increases. Germination of zygospores from each of the three width groups indicated that the respective width groups generally were maintained through germination. However, new width groups appeared and variation in germling cultures was greater than variation during vegetative growth of the original strains.

The cytology of all phases of the life history was studied and a general account of mitosis was given. No meiotic stages were seen in any phase of the life history investigated. Estimates of chromosome number confirmed that the three cell width groups represented a polyploid series: Group I, haploid (n=11-15); Group II, diploid (2n=26-30); and Group III, tetraploid (4n=56-60). It was suggested that increases in ploidy occurred through euploid steps and reversions through aneuploid steps.

The probable frequency of polyploidy in Spirogyra and the relative reliability of qualitative and quantitative characters were discussed in reference to taxonomic treatment of the genus. Group I (haploid) was determined as Spirogyra pratensis Transeau and the other width groups of the species complex were considered in relation to this determination.

Microfilm $3.95; Xerox $13.40. 306 pages.

PATHOGEN-SUSCEPT RELATIONSHIP OF MELOIDOGYNE INCOGNITA ACRITA AND GLYCINE MAX

(L. C. Card No. Mic 59-366)

Henry William Crittenden, Ph.D.
The Ohio State University, 1958

The soybean (Glycine max) was the leading crop plant (150,000 acres) in the state of Delaware during 1957. Two species of root-knot nematodes (Meloidogyne incognita acrita and Meloidogyne hapla) have been found on soybean in Delaware, and the former is more prevalent. Varieties of soybean resistant to M. incognita acrita are not the best from the agronomic viewpoint. To develop better varieties of soybeans with resistance to M. incognita acrita, a breeding and selection program has been in progress for several years. The pathogen-suscept relationship of M. incognita acrita and G. max was investigated to develop better techniques and gain more information on the nature of resistance and susceptibility in order that the soybean improvement program would be facilitated and accelerated.

As an aid in understanding the pathogen-suscept relationship, the tissues and cells of roots of susceptible soybean varieties (Adams, Virginia and Hakote) and of resistant soybean varieties (Laredo, Anderson, Mukden, Jackson and Blackhawk) were examined after invasion of the roots by the larvae of M. incognita acrita. Roots of the same varieties without nematodes were also studied, and roots were collected at 4, 8, 16, and 32 days after sowing of the seed. The time interval during which the soybean remains susceptible to the pathogen was investigated. The effects of roots of resistant and susceptible soybeans in the same pot on the number of nematodes invading the roots of each variety were explored.

No histological and cytological differences in the roots of susceptible and resistant varieties of Glycine max have been noted if the suscept was not inoculated with M. incognita acrita. However, differences were evident in the histopathology and cytopathology of susceptible and highly resistant roots after invasion by the pathogen. The space occupied by one group of giant cells in the root of a resistant variety is much smaller than the space occupied by a group of giant cells in the susceptible variety. In the resistant variety the head of the nematode is located at the side of the giant cells, whereas in the susceptible variety the head of the nematode is surrounded by giant cells. In the susceptible soybean roots, the giant cells had dense cytoplasm, and walls of the giant cells were irregularly thickened. The giant cells in resistant soybean roots had less dense cytoplasm, and the giant cell walls were not irregularly thickened.

In the areas of larval invasion of the susceptible soybean varieties, the increased number and size of cells in the pericycle of roots was a very prominent characteristic, whereas the increase was present to only a small degree, if at all, in the highly resistant varieties. There was a reduction in the number of tertiary roots in susceptible varieties when the primary and secondary roots had been invaded by the pathogen.

Varieties were most susceptible to M. incognita acrita when inoculated at time of seed sowing, but remained susceptible to some degree for nine weeks after seed sowing. Resistant and susceptible plants growing in the same container had no effect on the invasion of the roots of either variety by the pathogen.

Microfilm $2.00; Xerox $3.00. 58 pages.

MORPHOLOGICAL STUDIES OF DIPLOID AND AUTOTETRAPLOID PLANTS OF PHYSALIS PRUINOSA L.

(L. C. Card No. Mic 59-381)

Robert David Henry, Ph.D.
The Ohio State University, 1958

A study of Physalis pruinosa L. was conducted to contribute to the morphological knowledge of this relatively little studied genus, as well as to the economically important family in which it is classified, the Solanaceae. Because of the interest in the use of polyploids in agriculture, the comparative morphology of diploid and colchicine-induced autotetraploid plants was studied. This included a study on general morphology and growth, pre- and post-fertilization morphology, autotetraploid sterility and preliminary studies on parthenocarpy. Material studied microscopically was prepared by using standard microtechnique methods. An effective method of observing pollen tubes in the styles is described.

The autotetraploid plants had larger leaves, pollen, flowers, and seeds than the diploids. The leaves of the tetraploid were darker green, the stomates larger, and the stomatal frequency less than in the diploids. The greener color was due to a larger number of chloroplasts, and the larger leaves were due to an increase in cell size. The pollen of the tetraploid had a higher amount of abortion, a greater variation in size, and a greater variation in the number of germ pores than that of the diploid. Mature fruits of each were often externally indistinguishable on the basis of their size. This was apparently due to a lower seed set in the tetraploid which resulted in smaller fruits than might normally be expected. Seed germination, initial plant growth, and flowering were found to be slower in the tetraploids, although a later increase in growth rate did occur with the diploids in some instances. The tetraploid plant generally had fewer branches than the diploid.

Megasporogenesis, megagametophyte and pollen formation were similar in both diploid and tetraploid plants. A hypodermal archesporial cell functions as the megaspore mother cell which divides and forms a linear tetrad of four megaspores; all except the chalazal one disintegrate. Development of the embryo sac follows the normal (Polygonum) type. The mature embryo sac lies within an integumental endothelium. Pollen formation is simultaneous and the mature pollen grains are 2-nucleate. Fertilization generally occurs 24 to 48 hours after pollination and is porogamous. The endosperm nucleus divides soon after formation and a cellular endosperm is formed. The zygote does not divide immediately after formation. A linear 4-celled embryo is formed. Four types of development of the 8-celled embryo were observed in the diploid; three and possibly four types were found in the tetraploid. Other variations in the configuration of the 8-celled embryo in both were also noted. The young seed coat appeared to enlarge primarily because of periclinal cell divisions.

The low seed set of the autotetraploid plant appears to be largely due to pollen tube inhibition in the ovulary, which results in a reduced amount of fertilization. Embryo sac and post-fertilization abortion were involved to a lesser degree.

Parthenocarpic fruits enclosed in an enlarged calyx were obtained by the application of a 0.25 per cent naphthaleneacetic acid-lanolin mixture on the stigmas of both diploid and autotetraploid plants. These fruits were smaller than those formed as a result of self-pollination. Parthenogenesis was not observed.

The morphology of Physalis pruinosa L. as found in this study is, in general, similar to that found to be characteristic of other members of the Solanaceae.

Microfilm $2.00; Xerox $5.00. 98 pages.

A STUDY OF THE EFFECT OF THE TRACE ELEMENTS, MANGANESE AND MOLYBDENUM, UPON THE SOLUBLE NITROGENOUS CONSTITUENTS OF PLANTS

(L. C. Card No. Mic 59-449)

David Margolis, Ph.D.
Cornell University, 1958

Major Professor: F. C. Steward

Both manganese and molybdenum are known to be essential nutrients for the growth of higher plants but their functions in metabolism are imperfectly known. The work described in this thesis is concerned with a study of the effects of the two trace elements upon one phase of plant metabolism: the soluble amino acids are amides as influenced by the assimilation of nitrate and ammonium nitrogen.

Tomato plants were grown in water and sand culture and supplied either nitrate or ammonium as sources of nitrogen. The techniques used to establish manganese and molybdenum deficient plants are described. Two general types of experiments were performed: the first concerned plants with progressively increasing severity of trace element deficiency and the second dealt with the recovery of the trace element deficient plant upon the resupply of the missing component. The separation and detection of the nitrogen compounds which occur in the plants was achieved by the use of partition chromatography on paper and the subsequent analysis of amino acids was done by use of the controlled reaction of ninhydrin with amino compounds on paper. The leaves, roots and stems of the plant were separately analyzed.

Wide fluctuations in the concentration of the soluble amino acids and amides of tomato plants occurred and these were dependent upon the trace elements. The major effect of manganese deficiency, in relation to the amino compounds, is to produce an accumulation of asparagine and the major effect of the addition of manganese is to reduce the level of asparagine and increase that of glutamine. Deficiency of molybdenum reduced the concentrations of most of the amino compounds and of glutamine, in particular. Recovery from molybdenum deficiency coincide with the immediate and massive synthesis of glutamine and secondarily of some other soluble amino acids.

It was concluded that the concentrations of the soluble amino compounds in plants is controlled by manganese through its ability to govern the level of the organic acid and keto-acid precursors of amino acids and to control the conversion of glutamine to protein.

The patterns of amino acids obtained with molybdenum nutrition could be explained by its role in nitrate reduction and its ability to inhibit phosphatases.

The significance of the experimental data is evaluated with due regard to an extensive literature in this field.

Microfilm $3.55; Xerox $12.20. 276 pages.

THE TAXONOMY OF HELIANTHUS ANGUSTIFOLIUS AND RELATED SPECIES

(L. C. Card No. Mic 58-7925)

William Clarence Martin, Jr., Ph.D.
Indiana University, 1958

The genus Helianthus, because of the complex relationships between its species, has for some time been a source of difficulty to the taxonomist. Many species are extremely variable and boundaries between species are many times indistinct.

The present work is a study of a number of species from the southeastern United States which have not previously been given detailed attention. One of these species, Helianthus agrestis is an annual, and the remainder (H. angustifolius, H. atrorubens, H. carnosus, H. floridanus, H. heterophyllus, H. longifolius, H. radula and H. salicifolius) are perennials. In order to more accurately determine the species relationships, several lines of investigation were followed by the writer, namely, morphological studies of herbarium specimens and living plants in nature and in the experimental garden, chromosome counts from as many sources as possible, a hybridization program, and determination of the geographical distribution of these species.

All of these species are diploid with n=17 and show normal pairing of chromosomes at meiosis.

Helianthus angustifolius was found to be the most variable species in the southeastern group, closely followed in this respect by H. atrorubens and H. floridanus. H. carnosus showed almost a complete lack of variation. The amount of variation displayed seems to be in a large measure directly proportional to the extent of the range of the species. H. angustifolius is found in twenty-two states and H. carnosus is limited to three counties in Florida. The extreme variability in H. angustifolius is probably the result of the influence of various ecological factors as well as hybridization with other species.

Helianthus angustifolius and H. floridanus were found to be very closely related species. Although these species give highly fertile artificial hybrids and hybridize to some extent in nature, it seems best to regard them as separate species on the basis of slight but consistent morphological differences.

Helianthus heterophyllus is of special interest because morphologically it is intermediate between H. angustifolius and H. radula, although at present there is no evidence that it is a hybrid of these two species.

Putative hybrids between H. atrorubens and H. angustifolius, H. atrorubens and H. longifolius, H. angustifolius

and H. heterophyllus, H. angustifolius and H. salicifolius, and H. angustifolius and H. floridanus were found during the course of the study. Artificial crosses between H. floridanus and H. longifolius, H. angustifolius and H. longifolius, H. floridanus and H. debilis, H. angustifolius and H. niveus, and H. angustifolius and H. maximilliani were successfully made. Except for this single cross between H. floridanus and H. debilis, attempts at crossing annual with perennial sunflowers were unsuccessful.

Microfilm $2.00; Xerox $7.00. 147 pages.

STUDIES ON GLUCOSE DISSIMILATION IN USTILAGO MAYDIS

(L. C. Card No. Mic 59-277)

Richard Davis McKinsey, Ph.D.
Stanford University, 1958

The objective of the research was to discover the general nature and relative importance of the pathways by which glucose is dissimilated by Ustilago maydis. Knowledge of the carbohydrate metabolism of this fungus is of value because of its importance as a plant pathogen (casual agent of corn smut) and its evolutionary significance as a member of the Hemibasidiomycetes (smuts, rusts, and jelly fungi).

The metabolism was investigated by means of manometric, spectrophotometric, and isotopic tracer techniques and growth studies.

The growth studies demonstrated that Ustilago maydis is an obligate aerobe. Cells were unable to grow in the absence of oxygen, and cell-free extracts showed no carbon dioxide production in an atmosphere of nitrogen.

Glucose, fructose-1,6-diphosphate, 3-phosphogluconic acid and pyruvate were metabolized by cell-free extracts.

The following enzymes of the Embden-Meyerhof-Parnas pathway were demonstrated in cell-free extracts: aldolase, DPN-coupled 3-phosphoglyceraldehyde dehydrogenase, phosphoglyceryl kinase, and ethanol dehydrogenase. Two enzymes of the monophosphate shunt were demonstrated: glucose-6-phosphate dehydrogenase and 6-phosphogluconic acid dehydrogenase.

The relative quantitative significance of the monophosphate shunt and the Embden-Meyerhof-Parnas pathways was ascertained by the use of glucose-6-C^{14} and glucose-1-C^{14} as substrates. Experiments of sixteen and twenty-four hours duration gave $\frac{\%\ 6\text{-}C^{14}\ \text{yield in carbon dioxide}}{\%\ 1\text{-}C^{14}\ \text{yield in carbon dioxide}}$ of 0.23 and 0.54 respectively. The increase in the ratio with an increase in the duration of growth indicates the necessity of taking measurement during the early stages of growth in order to ascertain the true quantitative significance of the monophosphate shunt.

The demonstration of the presence in Ustilago maydis of a number of the enzymes of the Embden-Meyerhof-Parnas pathway was evidence for the presence of this pathway in the organism. The ability of cell-free extracts of Ustilago maydis to metabolize intermediates of the pathway was in agreement with the enzyme studies.

The presence of the hexose monophosphate shunt in Ustilago maydis was suggested by the demonstration of the presence of glucose-6-phosphate dehydrogenase and 6-phosphogluconic acid dehydrogenase in cell-free extracts. The indications of the presence of this pathway were confirmed by the results of experiments utilizing radioactive glucose. The $\frac{C6}{C1}$ ratio of 0.23 obtained suggested that a great deal of the glucose was being metabolized via a pathway which preferentially removed the number one carbon atom of glucose as carbon dioxide. In view of the fact that the presence of glucose-6-phosphate dehydrogenase and 6-phosphogluconic acid dehydrogenase was demonstrated, it would seem very probable that much of the glucose was being metabolized by way of phosphogluconic acid.

Microfilm $2.00; Xerox $4.60. 90 pages.

EFFECTS OF ANTIBIOTICS ON CONTROL OF ANGULAR LEAF SPOT OF COTTON

(L. C. Card No. Mic 59-1145)

Paul Franklin Street, Ph.D.
Iowa State College, 1958

Supervisor: Wendell H. Bragonier

One of the three most important diseases of cotton is known as angular leaf spot or bacterial blight. The pathogen, Xanthomonas malvacearum, is a seed bourne bacterium which causes, in addition to a seedling infection and a leaf spotting, a "black arm" symptom on stems and petioles and a "boll rot". Since certain chemicals including antibiotics have been recommended for controlling bacterial plant diseases, experiments were conducted to determine the effectiveness of the more promising materials for controlling this pathogen.

In replicated field trials in 1955 and 1957 in Texas, five antibiotics, Aureomycin, Neomycin, Penicillin, Streptomycin and Terramycin applied to the foliage of cotton plants at rates of 5 and 10 ppm. failed to prevent infection of leaves, stems and bolls by X. malvacearum. The bacteria were sprayed on the leaves following the antibiotic sprays and all plants in the experiment became infected equally. Apparently these rates based on in vitro tests were too low to be effective.

In the fall of 1957 and winter of 1958, a greenhouse experiment based on preliminary observations, was planned with four rates of two fungicides, Ceresan and Omadine, and two antibiotics, Streptomycin and Mycostatin, applied to acid delinted seed of two cotton varieties, Deltapine and Rowden, previously inoculated by soaking in an aqueous suspension of a mixture of races 1 and 2 of X. malvacearum. Plots consisted of 10 seeds planted at one inch intervals in metal flats of greenhouse soil, steamed at 15 lbs. pressure for three hours. Untreated, inoculated rows of seed were included as zero rates for each chemical and variety, making a total of 40 rows, 5 (rates) x 4 (chemicals) x 2 (varieties), per replication; 16 replications were planted. Soil temperatures were maintained at 85°F. and all flats were watered to the same extent daily.

The emergent seedlings were counted and each cotyledon was assigned to a class based on the percentage of the surface infected with X. malvacearum as follows: Class 1, no disease; Class 2, 0 to 10 percent diseased; Class 3,

11 to 40 percent diseased; Class 4, 41 to 90 percent diseased; Class 5, 91 to 100 percent diseased. The data revealed, after analyses of variance and covariance had been computed and adjustments to equal numbers of plants per plot had been made, Ceresan applied as a dust to the inoculated seeds at rates of 2, 4, 8, and 10 oz. per 100 lbs. of seed caused significant increases in stand for the variety Deltapine in comparison with the untreated check. Also, a significant reduction in cotyledonary infection resulted from treatment of the variety Deltapine with 2 oz. and the variety Rowden with 4 oz. per 100 lbs of seed. For Omadine (1, 2, 4, and 8 oz. per 100 lbs. of seed), the 8 oz. rate caused a significant reduction in cotyledonary infection for the variety Rowden, only. A significant increase in cotyledonary infection resulted from treatment of the variety Deltapine with 1000 ppm. of Streptomycin, the highest rate. Since the methyl alcohol used to dissolve the Mycostatin was toxic to the seeds, none of the plants emerged and Mycostatin was not included in the analyses. In general, treatment with Ceresan resulted in better stands and less cotyledonary infection than treatment with the other chemicals, and the variety Deltapine responded more favorably to treatment than the variety Rowden.

Microfilm $2.00; Xerox $4.00. 75 pages.

DRYING AND GERMINABILITY OF MAIZE

(L. C. Card No. Mic 59-1146)

William Marshall Struve, Ph.D.
Iowa State College, 1958

Supervisor: W. E. Loomis

The effect of drying rate on the viability and vigor of seed corn was determined for seeds harvested at various moisture levels. The seeds were dried slowly in air under laboratory conditions, or more rapidly in vacuum at 30, 40, or 50° C. The viability and vigor of the dried seeds were determined by one or more growth tests with the growth conditions ranging from near optimum to those comparable to poor field conditions.

It was found that grain harvested with more than about 25 per cent moisture and dried rapidly showed reduced viability and vigor. Injury increased with initial moisture content. The vigor of the seeds dried to less than 20 per cent moisture by combinations of the slow and rapid drying methods indicated that the damage was a function of the drying rate over critical moisture levels, and particularly of the rate between 40 and 30 per cent moisture. Vigor losses of the seeds dried to 20 per cent moisture or less in a matter of hours are believed to be due to the prevention of certain protoplasmic adjustments in the drying seeds.

The effect of temperature, oxygen, and moisture content on the viability and vigor of seed corn stored for various periods was determined by sealing the seeds with various levels of oxygen and storing at temperatures ranging from -30° C to 50° C. The growth performance of these seeds was determined as for those of the drying experiment.

It was found that storage in 20 per cent (air) or higher oxygen resulted in death of the seeds at a rate which was increased by higher moisture percentages in the range 0 to 11 per cent, and by higher temperatures in the range 0 to 50° C. Seeds with zero per cent moisture, stored in pure nitrogen, were injured when stored at 50° C for more than one year, and were nearly dead after 31 months. The autoxidation of lipid material in severely injured seeds stored with oxygen was indicated by their rancid odor.

Storage of completely dry seeds at low temperatures in an oxygen free medium has resulted in maintaining viability and vigor at a maximum level. Seeds at four per cent moisture were not greatly different from those at zero, but seeds at eight per cent were rather rapidly injured.

Microfilm $2.00; Xerox $4.40. 83 pages.

SEXUAL ISOLATION IN PANDORINA MORUM BORY

(L. C. Card No. Mic 58-7939)

Annette Dunshee Wilbois, Ph.D.
Indiana University, 1958

Pandorina morum Bory is a species of colonial green flagellate which is found in fresh water ponds throughout the world. The life cycle includes both asexual and sexual modes of reproduction, the latter producing a zygote by fusion of two motile gametes of variable sizes. Meiosis occurs at the germination of the zygospore and a single meiotic product survives. Genetic analyses of zygote products indicate that the factor for mating type in heterothallic strains behaves as a single locus with two alleles. One strain which was closely examined has twelve chromosomes; several others appear to have a similar number.

Strains of P. morum have been maintained in a chemically defined medium of inorganic salts for more than two years. Under the conditions of the present study, the organism was found to be an obligate autotroph. The occurrence of mating in a mixed culture is dependent upon the concentrations of salts present during vegetative growth. In a suitably constituted medium, sexually mature colonies appear after the nitrogen supply has become depleted, limiting further growth. Light is apparently necessary for all stages of the mating process, but an excessive period of illumination can block the mating potential of cells. The mating potential may be restored by a period of darkness.

In most heterothallic strains, gamete production requires the presence of colonies of both complementary mating types; in such strains, however, similar gamete production could be induced by treatment of colonies of one mating type with cell-free culture fluid from cultures of the complementary mating type. The active substance(s) in the culture supernatant is non-dialysable and resistant to temperatures of 100°C. It induces gamete formation and gamete clumping.

A number of strains from various areas of the United States, all essentially indistinguishable on morphological grounds, were analyzed for sexual compatibility. Forty-seven heterothallic clones were found to represent fifteen separate pairs of mating types, or a minimum of fifteen syngens (sensu Sonneborn, 1957). Two clones proved to be homothallic. Nine additional clones, which have not been observed to mate with any strain, can be classified only after further collecting. The separate heterothallic pairs of mating types are sexually isolated by factors acting at the stage of gamete production; incompatible mating types

produce no gametes when they are mixed together. The geographical distribution of the sets of mating types is very incompletely defined as yet, but they are not strictly endemic forms.

Thirty heterothallic strains, representing each of the fifteen sexually isolated sets of mating types of P. morum, one homothallic P. morum strain, and two heterothallic strains of P. charkowiensis have been deposited with the Culture Collection of Algae maintained at Indiana University, Bloomington, Indiana, U. S. A.

Microfilm $2.00; Xerox $5.60. 115 pages.

THE COMPARATIVE MORPHOLOGY OF THE CANELLACEAE

(L. C. Card No. Mic 58-7940)

Thomas Kendrick Wilson, Ph.D.
Indiana University, 1958

The Canellaceae, which are small trees of tropical distribution, comprise six well-recognized genera and about twenty-one species. The New World genera include: Canella Murray, with two species, ranging from lower Florida, throughout the West Indies, and into northern South America; Pleodendron Van Tieghem, with two species in Puerto Rico and Haiti; Cinnamodendron Endlicher, with seven species in Brazil, Surinam, and the West Indies; Capsicodendron Hoehne, with two species in Brazil. The Old World genera consist of Warburgia Engler, with four species in Eastern Africa, and Cinnamosma Baillon, with three species endemic to Madagascar.

No detailed morphological-anatomical study has been made of this family previous to this time, and there is no comprehensive revision in existence. In addition, the taxonomic position of the Canellaceae is not at all clear, having at one time or another been allied with the Annonales, Bixales, Gutifferales, Magnoliales, Parietales and Ranales.

A comprehensive study of the floral anatomy, nodal anatomy, pollen morphology, xylem anatomy and gross morphological characteristics of the Canellaceae, and a comparison with other related families has been made. It is hoped that the evidence herein provided will aid in clarifying the phylogenetic position of this taxon.

The anatomy of the wood studied shows some fairly advanced features in the characters of the rays, but the other features of the wood point to a low level of specialization. There is more similarity between the wood of the Canellaceae and the woody Ranales than between the Canellaceae and the Parietales. Among ranalian families the wood of the Eupteleaceae, Dilleniaceae, Eupomatiaceae, Illiciaceae and Schisandraceae are most like that of the Canellaceae.

The investigation of the anatomy of the foliar node of the Canellaceae reveals that the node is of the trilacunar type, the type found in the majority of the Archichlmydeae. There is some indication that the median trace is derived from two separate bundles of the eustele. Evidence from the node is inconclusive in determining the affinities of the Canellaceae, as both ranalian and parietalian families are also characterized by trilacunar nodes.

Pollen of all six genera of the Canellaceae was found to be of the monosulcate type, a type which is found, among angiosperms, only in the Ranales. Furthermore, pollen of the Myristicaceae is most similar to that of the Canellaceae.

A study of the floral morphology reveals that the flowers of the Canellaceae are quite highly evolved, but with some primitive features. There seems to be no family in either the Ranales or the Parietales with which the flowers of the Canellaceae can be favorably compared, with the possible exception of Myristicaceae.

Other than a tendency toward the lack of any palisade tissue and stomata transitional between rubiaceous and ranunculaceous types, there are no particular outstanding features about the leaves of the Canellaceae. Evidence from the leaves is inconclusive in establishing any relationship. Conspicuous features of all vegetative and floral organs in the Canellaceae are the large, spherical oil cells. These oil cells are quite common within the Ranales.

It is recommended that, on the basis of all evidence available, the Canellaceae be removed from the Parietales and placed in the Ranales. The exact placement within the Ranales is not definite at this time, but in all probability it should be placed in the proximity of the Myristicaceae.

Microfilm $2.00; Xerox $6.40. 134 pages.

CHEMISTRY, GENERAL

THE EMISSION SPECTROGRAPHIC DETERMINATION OF NITROGEN IN STEELS

(L. C. Card No. Mic 59-1135)

Raymond Jasinski, Ph.D.
Iowa State College, 1958

Supervisor: V. A. Fassel

Since the presence of trace impurities of oxygen and nitrogen may exert a degrading influence on the physical and mechanical properties of metals it is essential to control the gaseous element content of metals within tolerable limits. Analytical methods are therefore required which are capable of determining trace quantities of these elements in metals with sufficient accuracy and rapidity to be useful for production control. Techniques have been developed in these laboratories for the spectrographic determination of oxygen in metals. A rapid, simultaneous emission spectrographic determination of oxygen and nitrogen possesses significant advantages in time-of-analysis for the routine, control determination of gases in steels. It is also of academic interest to determine whether nitrogen, another non-metal, can be determined by emission spectrographic techniques.

Since some nitrogen was evolved from steel samples under the experimental conditions employed for oxygen analysis, it was of first interest to establish which nitrogen containing specie could be detected by a D.C. arc discharge in an argon atmosphere containing traces of nitrogen. The cyanogen band head at 3883A was detected in an argon atmosphere containing 0.003% nitrogen. Similarly, a nitrogen atom line at 8216A was detected in an argon atmosphere containing 0.01% nitrogen. Selected argon lines served as internal standard lines.

Arcing the sample in a purified, static argon atmosphere at 25 amperes for two minutes insured the maximum evolution of the nitrogen from the steel sample.

The main experimental difficulty associated with this technique was the contamination of the purified argon atmosphere with nitrogen liberated from the walls of the excitation chamber or from the supporting electrodes during the excitation cycle. This source of error was reduced to tolerable proportions by careful design of the excitation chamber and through rigorous outgassing of the electrodes and chamber.

Steels containing significant amounts (about 10%) of volatile elements such as manganese could not be analyzed directly by this technique. If however, the arc was discontinued after a predetermined prearc period, and an auxiliary electrode moved into position for arcing, the subsequent exposure yielded consistent intensity ratios.

This spectrographic method for the determination of nitrogen in low alloy and high alloy steels was developed in the concentration range 0.01% to 0.24% nitrogen. The standard deviation was less than ± 5% of the amount reported. The intensity ratio of the line pair N 8216A/ Ar 8179A, was measured. An extension of the limit of detection to 0.003% nitrogen was achieved by the use of cyanogen radiation. However, the standard deviation of analysis was increased to ± 14% of the amount reported.

Microfilm $2.00; Xerox $5.20. 101 pages.

PART I: CONCENTRATION EQUILIBRIUM CONSTANTS OF URANYL AND CADMIUM IONS IN REACTIONS WITH A CATION-EXCHANGER. PART II: THE EFFECT OF ADDITION AGENTS ON THE CATHODE POLARIZATION AND CATHODE DEPOSITS IN COPPER SULPHATE SOLUTIONS

(L. C. Card No. Mic 58-1226)

William Neil McKay, Ph.D.
University of Colorado, 1957

Supervisor: Professor Harold F. Walton

Uranyl and cadmium ions both form complexes in solution with the sulphate ion. Since Dowex-50 is a sulphonated polystyrene resin, there was a possibility of complex formation in the resin phase. Constant volumes of the cation solutions were mixed with varying amounts of resin, then shaken for at least six hours to attain equilibrium in the reaction $M^{++} + 2ResH \rightleftharpoons M(Res)_2 + 2H^+$. M^{++} stands for the metal cation, ResH for the acid form of the resin. Exchange runs were made at 0°C, 25°C, 50°C and 90°C. The mixture was filtered quickly and the resin was eluted to remove the M^{++} from MR_2 with 2N HCl. The values M^{++}, $M(Res)_2$ and H^+ were determined directly, whereas the ResH was determined indirectly. Material balance checks as well as other calculations revealed that the exchange was equivalent, with no complexing in the resin phase.

The concentration equilibrium constant (K_m) was defined as $[M(Res)_2][H^+]^2/[M^{++}][ResH]^2$. The concentrations in the resin phase were expressed in milliequivalents per gram, the solution phase in milliequivalents per millilitre. A plot of K_m versus the equivalent fraction of $M(Res)_2$ in the resin phase $N_{M(Res)_2}$ were made for each temperature. The results indicated: (1) at low temperatures, there was an optimum $N_{M(Res)_2}$ for maximum exchange; (2) at high temperatures, the UO_2^{++} was preferentially absorbed at low $N_{m(Res)_2}$; (3) the calculated heat of reaction for the UO_2^{++} -H^+ exchange was about 2 kilocalories per gram equivalent, and that for the Cd^{++} -H^+ exchange was about 700 calories per gram equivalent; (4) the extent of hydration appeared to be a governing factor.

Many different solutions are known which enable a high degree of brightening to be attained in electrodeposition.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

There have been extensive investigations into the mechanisms of reduction of the metal ion, and the most acceptable theory is the Direct Reduction of the Complex Theory, in which the complex does not undergo a prior dissociation before reduction. The brightening is generally believed to be due to the inclusion of some of the addition agent in the deposit, and this hinders orientation of the deposited metal atoms into crystal formation. Thus a bright deposit does not necessarily mean a pure deposit.

A measurable property of the electrodeposition is the cathode polarization. An investigation was made into the effects of various inorganic and organic addition agents on the cathode polarization, and the nature of the cathode deposit. Since copper is a readily available metal, a 0.1M $CuSO_4$ solution was used as a base solution, with copper electrodes and a fixed position copper indicator electrode. Electrolysis was carried out at varying and constant current densities, at temperatures of 20°C. and 50°C. The results indicated: (1) organic addition agents gave brighter deposits than inorganic agents; (2) current efficiencies were generally higher with organic addition agents; (3) the higher temperature favored brighter deposits; (4) with some addition agents, an intermediate cuprous ion was formed; (5) the cathode polarization curve could possibly be used as an analytical tool.

Microfilm $2.05; Xerox $7.40. 156 pages.

CHEMISTRY, BIOLOGICAL

BIOCHEMICAL INDIVIDUALITY: URINARY SULFUR PATTERNS

(L. C. Card No. Mic 59-188)

Gerald Francis Doebbler, Ph.D.
The University of Texas, 1957

Supervisor: R. J. Williams

Individual urinary excretion patterns were compiled on ten healthy and two cystinuric men with respect to creatinine, total sulfur, inorganic sulfate, thiocyanate, thiosulfate, esters of sulfuric acid, tyrosine sulfate, indoxyl sulfate, methionine, cystine, and taurine. Intra- and inter-individual peculiarities were evaluated. Identical twins resembled one another closely; non-twin brothers did not.

A fractionation and analysis procedure was developed, employing ion exchange and paper chromatography and yeast total sulfur assay, for the separation and semi-quantitative determination of urinary sulfur compounds at microgram levels. Application of this procedure to urine specimens revealed qualitative and quantitative inter-individual differences.

Two cystinurics were shown to be significantly higher than healthy individuals with respect to urinary levels of thiocyanate, thiosulfate, methionine, cystine, tyrosine sulfate, and hippuric acid.

Microfilm $2.00; Xerox $6.80. 141 pages.

A STUDY OF SOME METABOLIC PATTERNS IN ALCOHOLIC AND SCHIZOPHRENIC INDIVIDUALS

(L. C. Card No. Mic 59-189)

Hertta-Maija Häkkinen, Ph.D.
The University of Texas, 1957

Supervisor: Roger J. Williams

Since earlier studies both in this laboratory and elsewhere indicated that distinctive metabolic patterns probably exist in both alcoholics and schizophrenics when compared with control subjects, it seemed important to investigate further certain items in a larger population. Five such items were chosen for this study.

Total leucocytes, lymphocytes, eosinophiles, blood sugar, and urinary hippuric acid were determined in 57 alcoholics, 78 schizophrenics, and 45 controls. The initial levels of these items and the changes in the levels in response to a 2-dose glucose tolerance test were investigated. These same determinations were repeated in the alcoholic and schizophrenic subjects after a period of vitamin supplementation.

In the initial determinations total leucocytes, lymphocytes, eosinophiles, fasting blood sugar, and urinary hippuric acid were each found to be significantly higher (at the 1 per cent confidence level or better) in the alcoholic group as compared with the non-alcoholic controls.

The levels of these 4 blood constituents were higher in the schizophrenic than in the control group, the differences in the lymphocyte and eosinophile counts being significant at the 1 and 0.1 per cent levels of confidence, respectively.

Total leucocytes, lymphocytes, eosinophiles, and urinary hippuric acid were found to be significantly higher (at the 0.1 per cent confidence level) in the alcoholic group as compared with the schizophrenics.

Large variations from individual to individual were observed in both the alcoholic and the schizophrenic groups; such variations were even larger in the alcoholic group than among the schizophrenics.

Except for the change in lymphocyte count, the 3 groups of subjects responded similarly to the stress of a 2-dose glucose tolerance test.

Administration of vitamins over periods of up to 6 weeks appeared to make few significant changes in the levels of the items studied.

Similarities in the metabolic patterns of alcoholics and schizophrenics were observed.

Microfilm $2.00; Xerox $6.20. 128 pages.

FREE AMINO NITROGEN AND SERUM PROTEINS DURING LIVER REGENERATION ON A PROTEIN-FREE DIET

(L. C. Card No. Mic 59-127)

Gustav Richard Jansen, Ph.D.
Cornell University, 1958

Liver regeneration after partial hepatectomy in protein depleted rats is interesting in that the source of protein for the regenerating liver must be extra-hepatic tissue protein. This transfer takes place either as plasma

proteins, peptides or free amino acids in the blood. The following study has been made to study this process of protein transfer.

The free amino nitrogen, individual free amino acid, total serum protein and individual serum protein concentrations have been determined in plasma, liver and muscle of normally fed rats, rats on a protein-free diet, after laparotomies and after partial hepatectomies in rats on protein-free diets. The duration of the experiment was 12 days. Free amino nitrogen levels were determined by the colorimetric method of Krauel and the individual free amino acids were determined by the ninhydrin quantitative paper chromatographic procedure of Thompson et al. Total serum protein concentration was determined by a quantitative biuret procedure and individual serum proteins by electrophoresis. The following observations were made:

1. Administration of a protein-free diet caused virtually no change in the plasma level of free amino nitrogen, but caused decreases in liver and muscle.

2. On the first day after partial hepatectomy there is a pronounced increase in the free amino nitrogen level in plasma to values four times controls. This returns to control values on the second day and for the next five days doesn't differ from controls.

3. There were increases in free amino nitrogen in the liver and muscle on the first day after lobectomy and in the liver on the third day after lobectomy.

4. Paper chromatography showed that all of the amino acids participated in the large increase in plasma, although not all to the same degree. In all the tissues studied lysine and threonine increased the most on the first day after lobectomy. The amount of glutamine in the liver on the first day after lobectomy was very low compared with controls. The glutamine/glutamic acid ratio in the liver on this first day was 0.75 as compared with 2.58 in controls.

5. A protein-free diet lowers both the total protein concentration and the albumin/globulin ratio in serum. Laparotomies caused no significant change in the total serum protein concentration, but caused a sharp drop in the albumin/globulin ratio. Lobectomies performed on rats on a protein-free diet decrease the A/G ratio and also lower the total serum protein concentration until at the end of the period studied the loss in serum protein concentration is double the loss suffered by rats on a protein-free diet alone. The first day after partial hepatectomy is characterized by a large increase in γ globulin in the serum.

The following explanations have been offered to explain the data obtained:

1. The large increase in the plasma is caused by a combination of the removal of two-thirds of the liver tissue and a shock-like inpairment of liver function in the remnant. An inadequate deamination rate results and the condition is accentuated by adrenal cortical stimulation of peripheral protein catabolism. The increases in liver and muscle are related to these conditions.

2. A higher glutamine/glutamate ratio is present in tissues that are more actively catabolizing protein, and a lower ratio is found in tissues that are anabolizing or less actively catabolizing protein.

3. When partial hepatectomy and subsequent liver regeneration is superimposed on an already existing condition of protein deficiency the effect of the two conditions on the serum proteins is additive as both the drops in serum protein concentration and in albumin/globulin ratio are intensified. Microfilm $2.00; Xerox $5.60. 113 pages.

STUDIES ON THE NATURE OF THE SECONDARY IMMUNOLOGICAL RESPONSE

(L. C. Card No. Mic 58-7928)

Becca Catherine Patras, Ph.D.
Indiana University, 1958

The purpose of this work was to investigate the possibility that a significant portion of the antibody found circulating during the secondary immunological response is formed prior to the second injection of antigen (referred to as preformed antibody).

By the use of two isotopic labels such as S^{35} and C^{14}-amino acids, or two different C^{14}-amino acids, each injected during different periods of the immune response in the same animal, the contribution of the amount of antibody formed during each of these periods to the total amount found circulating at the time of maximum secondary response was estimated.

Rabbits were immunized by a series of subcutaneous injections of either ovalbumin or bovine gamma globulin. The animals were challenged by a secondary injection of the appropriate antigen about 34 days after the end of the primary sensitization. When S^{35}-amino acids were injected intraperitoneally at the time of the maximum primary response, and C^{14}-amino acids injected at the end of the eclipse period of the secondary response, the ratio $\frac{\text{CPM/mg antibody}}{\text{CPM/mg globulin}}$, or A_{Ab}/A_G, for C^{14} at the time of maximum secondary response was 1.5 to 1.8, whereas the A_{Ab}/A_G for S^{35} was 0.70 to 0.75. The latter ratio was only slightly higher than that observed for antibody formed during a primary response initiated about 30 days after injection of S^{35}-amino acids ($A_{Ab}/A_G = 0.61$). These results rule out the possibility that antibody formed at the time of maximum primary response is a significant portion of the antibody found circulating at the time of maximum secondary response. On the other hand, the data cannot exclude the possibility that a considerable portion of this antibody was formed a week or two prior to the second injection of antigen, since S^{35} specific activity of such antibody would be only slightly higher than that of antibody formed during the secondary response. The ratios A_{Ab}/A_G for C^{14} seems to indicate that 60-70% of this antibody is formed prior to the injection of C^{14}.

In order to estimate the amount of antibody formed during the eclipse period, S^{35}-amino acids were injected at the same time as the secondary injection of antigen, and C^{14}-amino acids injected three days later. The ratio A_{Ab}/A_G for S^{35} in the antibody isolated 5 days after the antigen injection was 0.77 to 0.91, whereas the ratio for C^{14} was 1.5 to 1.6. In a similar experiment, C^{14}-lysine or C^{14}-tyrosine plus phenylalanine was injected 3 days after the secondary antigen injection. The ratios $\frac{\text{CPM/mg amino acid in antibody}}{\text{CPM/mg amino acid in gamma globulin}}$ were 1.43 and 1.58 respectively. In these animals, C^{14}-arginine or C^{14}-histidine was injected at 0 time in the secondary response. The ratios in this case were 1.3 and 0.75 respectively. These results indicate that the amount of antibody synthesized during the eclipse period relative to the total amount is highly variable, and is 0-28% of the antibody found circulating at the time of maximum secondary response.

In the final experiment, two different but related

antigens were used to elicit a secondary type response. Rabbits sensitized for the primary response with arsanil-azo-bovine gamma globulin (ArABGG) were challenged with bovine gamma globulin (BGG). S^{35}-amino acids were injected during the primary response, whereas C^{14}-amino acids were injected during the secondary response. The resulting antibody was fractionated into anti-BGG and anti-ArABGG. In this case the S^{35}/C^{14} ratio of the two antibodies gives a clear indication of their relative times of formation. The ratios found were 0.20 and 0.40 for anti-BGG and 1.4 and 0.73 for anti-ArABGG. These results indicate that the anti-ArABGG was formed much earlier in the course of the immunization than the anti-BGG and was released during the secondary response.

Microfilm $2.00; Xerox $4.80. 95 pages.

STUDIES ON THE METABOLISM OF NONESSENTIAL AMINO ACIDS AND D-AMINO ACIDS IN THE RAT

(L. C. Card No. Mic 59-136)

Miloslav Rechcigl, Jr., Ph.D.
Cornell University, 1958

The Net Utilization of Nonspecific Nitrogen Sources for the Synthesis of Nonessential Amino Acids.

A study was made on the effectiveness of a mixture of essential L- and DL-amino acids, single nonessential amino acids, diammonium citrate, urea and biuret as a source of nitrogen for the biosynthesis of nonessential amino acids. These nitrogen supplements were added at isonitrogenous levels to a basal diet containing a mixture of essential amino acids, patterned after the composition of the rat carcass. The amino acids were present exclusively in the L form except in one instance where the DL-amino acids were specifically studied. Weanling albino rats of the Yale strain served as experimental animals. Average gain in weight, efficiency of food and nitrogen utilization and carcass analyses were criteria used for the evaluation of different diets.

L-glutamic acid and a mixture of essential L-amino acids were the most effective supplements when judged by the above criteria. These were followed by L-glutamine, L-aspartic acid, L-asparagine, L-alanine, L-proline, urea, biuret, diammonium citrate, glycine and L-serine; all arranged in order of their effectiveness in promoting growth. Diets containing L-hydroxyproline, or a mixture of racemic acids caused depression in growth rate. The growth depression in the latter case was traced to an isoleucine deficiency.

The rats fed urea gained more weight and consumed more food than the rats on diammonium citrate diets. When the carcasses of these two groups of animals were analyzed for nitrogen and the net protein value was determined, diammonium citrate seemed to be a more efficient source of nitrogen. The lower carcass protein content of rats fed the urea diet was accompanied by a greater fat deposition. No large changes were observed in the percentage carcass composition of other groups of rats.

The observed differences in the total amount of moisture, protein and fat, for the most part, reflected the different body size of various groups. Size as well as the estimated caloric content of carcasses were primarily determined by the amount of food (calories) consumed.

The Utilization of D-Leucine for Growth by the Rat

Experiments have been conducted for the purpose of determining whether the unnatural isomer of leucine can be utilized by rats. The experimental procedure used was similar to that of the above study.

Rats ingesting the leucine-free diet for 4 weeks lost 13 gm of body weight as compared to the loss of 18 gm on a regimen completely lacking in the essential amino acids. Supplementation of the diet devoid of leucine with either enantiomorph of the latter resulted in a marked stimulation of growth. The animals fed D-leucine gained on the average 38 gm while the control group receiving L-leucine gained 56 gm during a 4 week experimental period.

If the D isomer of leucine is utilized one would anticipate a lower growth on a diet containing marginal amounts of L-leucine than on an identical diet supplemented with the same amount of D-leucine or on a diet containing the racemic acid fed at twice the concentration of L-leucine. The experimental data confirmed this postulate.

This is believed to be the first demonstration of the utilization of D-leucine for growth of the rat. The difference between the results of these studies and earlier studies to the contrary has been found to be due to the presence of norleucine in the basal diet used in the earlier work of other investigators.

Microfilm $2.00; Xerox $5.20. 104 pages.

FACTORS INFLUENCING FLUORIDE METABOLISM IN THE RAT

(L. C. Card No. Mic 58-7937)

Martin James Wagner, Ph.D.
Indiana University, 1958

Factors which affect the absorption and retention of aqueous fluorides were studied in the albino rat. The concentrations of fluoride studied were comparable to those found in communal water supplies for the partial reduction of the incidence of dental decay in children.

With the aid of specialized techniques for the accurate measurement of drinking-water consumption, it was found that slightly less fluoride was available for retention when given as a constituent of a fluoride-containing natural water than when given in a chemically pure sodium fluoride solution. The differences in retention was more apparent in a high-fluoride (8 ppm) water. The differences were attributed to interference with fluoride absorption by the inorganic constituents of the natural water.

Several inorganic ions common to water supplies were investigated for their effect on fluoride metabolism. A combination of calcium, magnesium, iron, and phosphate ions significantly reduced the retention of fluoride from a solution containing these elements when compared to a mineral-free fluoride solution. The individual ions, however exhibited little or no influence on fluoride retention, at the concentrations in natural water.

The absorption of fluoride from the gastrointestinal

tract occurs soon after ingestion. Ingestion of calcium and phosphorus salts at various times after fluoride administration interfered with further fluoride absorption and permitted a means of measuring the rate of fluoride absorption as well as studying the mode of action of the effect of calcium and phosphorus on fluoride metabolism. Ingestion of phosphate following fluoride ingestion significantly increased the retention of fluoride although calcium plus phosphate produced a substantial decrease in retention, when compared to the animals receiving only fluoride. The results of time studies with these interfering elements suggested that two milligrams fluoride was absorbed to a significant extent within 15 minutes following ingestion.

Diabetic rats excreted proportionately more fluoride than their corresponding controls, although not to a significant degree. The difference in retention of fluoride was not great enough to suggest that the metabolism of fluoride was altered to any appreciable extent by the diabetic condition.

The deposition of fluoride in heart, liver, and kidney after prolonged dosage at high levels of intake was not greater than in animals given no fluoride, suggesting that the normal balances between fluoride absorption, skeletal storage, soft-tissue deposition, and excretion are such that vital tissues are protected from the accumulation of fluoride.

Skeletal deposition of fluoride decreased markedly with increasing exposure to the element. Furthermore, the rate of retention appeared to be directly related to the rate of metabolism of bone constituents, since retention decreased substantially following the attainment of skeletal maturity. Microfilm $2.00; Xerox $5.60. 115 pages.

THE EFFECT OF A VITAMINE B_{12} DEFICIENCY ON LIPIDE METABOLISM

(L. C. Card No. Mic 59-142)

David Wayne Yesair, Ph.D.
Cornell University, 1958

A vitamin B_{12} deficiency in animals results in drastic metabolic upsets. Although the isolation of vitamin B_{12} in pure form was attained in 1948, the exact biochemical role has yet to be elucidated. From the voluminous literature, there is evidence that vitamin B_{12} may be involved in the metabolism of neutral fat, cholesterol, phospholipide and coenzyme A, a compound intimately concerned with lipide metabolism in general.

Three phases of lipide metabolism in vitamin B_{12}-deficient and normal chick embryos were studied at 12, 15, 18 and 21 days of age. These were the blood serum proteins and lipoproteins, phospholipides in the embryo, and palmityl thiokinase activity in the liver.

In the B_{12}-deficient embryo the blood serum proteins showed little change until the time of hatching. At this age, the serum protein was decreased significantly and fraction 5 (β globulin) was correspondingly decreased. The total lipide and lipoproteins of the serum underwent rapid changes during embryonic development. For the B_{12}-deficient serum the total lipide and β lipoprotein were increased, whereas the α lipoprotein was decreased at all stages of development.

Total phospholipide and the three fractions, lecithin, cephalin and sphingomyelin were decreased in the B_{12}-deficient embryo, with a statistically significant decrease at 21 days for all, and at 18 days for the cephalin fraction. Although growth of the embryo as measured by dry weight or total nitrogen was significantly retarded at 18 and 21 days of age, it was concluded that the total phospholipide synthesis at hatching was impaired to a greater extent than was growth. The three phospholipide fractions were not decreased proportionately in a B_{12} deficiency. Lecithin decrease was correlated with growth retardation; whereas, both cephalin and sphingomyelin were decreased to a greater extent than growth.

Percentage nitrogen was equivalent for the normal and deficient embryos for the period studied. Expressing phospholipide synthesis as a function of total nitrogen in the developing embryo further substantiated the fact that vitamin B_{12} impaired phospholipide synthesis prior to affecting nitrogen metabolism at 21 days of age. Although the phospholipide synthesis per gm. of embryo was not altered in the deficient embryo at 15 and 18 days of age, phospholipide levels were lower in the deficient embryo as compared to the normal control. It is suggested that vitamin B_{12} is involved in phospholipide synthesis.

A decrease in the synthesis of sphingosine, the nitrogenous base of sphingomyelin, was noted in a B_{12} deficiency; however, the decreased synthesis was directly proportional to growth retardation. This indicates that sphingosine synthesis was not a limiting factor for sphingomyelin formation.

The livers of the normal and B_{12}-deficient embryos were assayed for palmityl thiokinase activity. At 21 days of age the enzymatic activity of the deficient liver was significantly decreased as compared to the normal activity. This decrease was not due to decreased protein per cell or per liver for both were the same in the normal and deficient livers at 21 days of age. The enzymatic activity per liver in the B_{12}-deficient embryo at hatching was equivalent to the activity observed per deficient liver at 18 days of age. It was proposed that the decreased level of palmityl thiokinase activity was due to a decrease in vitamin B_{12} in the deficient liver.

From the experimental evidence presented, vitamin B_{12} appears to be involved in lipide metabolism. In conclusion a role for vitamin B_{12} was proposed in fatty acid activation reactions. This was discussed in terms of known abnormalities due to B_{12} deficiency and from the point of view that B_{12} has recently been described to be involved in the activation of amino acids.

Microfilm $2.00; Xerox $5.20. 103 pages.

THE MECHANISM OF THIAMINE ACTION

(L. C. Card No. Mic 59-1153)

Ralph Granville Yount, Ph.D.
Iowa State College, 1958

Supervisor: David E. Metzler

A non-enzymic model system in which thiamine in slightly basic solutions acts on pyruvate to yield acetoin, α-acetolactate and small amounts of unidentified products

has been studied in detail. This study has centered on the stoichiometry and kinetics of the reaction and on the synthesis and testing of the catalytic action of a variety of thiamine analogs on pyruvate. The following facts have been ascertained:

(1) Acetaldehyde is not a product in this reaction. It will, however, to a lesser degree substitute for pyruvate as a reactant to give acetoin.

(2) Carbon dioxide evolution begins at once but α-acetolactate and acetoin production exhibit a characteristic lag. The kinetics are approximately those of two consecutive first order reactions. The apparent first order rate constants for these reactions have been determined as a function of pH. The logs of both rate constants are linearly dependent on pH with log K_1 giving a slope of one and log K_2 giving a slope of 0.5.

(3) The kinetically recognized intermediate is either a thiamine-acetolactate or a thiamine-acetaldehyde compound. Evidence is presented which indicates that the two are in equilibrium but in which the rate limiting step is the breakdown of the thiamine-acetolactate compound. A mechanism is presented which purports to show the effect of pH on this equilibrium. A kinetic expression which fits both this mechanism and the pH dependence of K_2 is given. The intermediate is relatively stable to acid conditions and the possibility of isolating it under acid conditions is discussed.

(4) The pH optima for acetoin formation for both thiamine and 3-benzyl-4-methyl-5-(2-hydroxyethyl) thiazolium chloride correspond to the pHs of maximum zwitter-ion concentration, i.e., at the respective pK_{av}s for the thiazolium ring opening reaction. These latter pK_{av}s have been measured as a function of temperature.

(5) A number of thiamine analogs have been synthesized and tested for catalytic activity in converting pyruvate to acetoin. The thiazolium ring is necessary for catalytic activity, but the pyrimidine ring is not. Oxazolium salts, pyrithiamine, dihydrothiamine and tetrahydrothiamine are inactive. Oxythiamine, contrary to previous reports, is active but only at substantially higher pHs. All other salts tested which had activity were in essential agreement with the zwitter-ion mechanism of Breslow.

Microfilm $2.00; Xerox $5.00. 100 pages.

CHEMISTRY, INORGANIC

THE HYDRATION REACTION OF ANHYDRITE

(L. C. Card No. Mic 58-7912)

Robert Francis Conley, Ph.D.
Indiana University, 1958

The transformation of anhydrite, $CaSO_4$, to gypsum, $CaSO_4 \cdot 2H_2O$, in solution has been studied in detail.

Solutions of sodium sulfate and potassium sulfate are found to accelerate the transformation greatly. The hydration reaction in these media were studied at temperatures from 1° to 40° C. and with salt concentrations in the range 0.05 M to 2.00 M.

Anomalous yields are obtained with low temperatures (<10° C.) and Na_2SO_4 concentrations above 1.0 M. High yields are obtained at all concentrations of K_2SO_4 at 42° C., the limiting temperature of gypsum stability. Phase studies show that these results are produced by the formation of several double sulfate salts of sodium and calcium, and potassium and calcium, which subsequently decompose to gypsum upon washing.

Kinetic data collected under various conditions of acceleration indicate the order of reaction to be 2/3 and the reaction to take place via solution. This is shown to be a surface area phenomenon. From the kinetic data it also can be shown that the rate of reaction is limited by the surface area of gypsum at the beginning and by the surface area of the anhydrite at the end. Ion diffusion becomes a significant factor at the termination. An equation is derived, $\frac{dC_g}{dt} = k\,(C_g - C_g^2)^{2/3}$ and correlates moderately well with observed data.

Nucleation (amount of seed gypsum) and particle size effects are special extensions of the surface area dependence.

Temperature alters the solubility differential between anhydrite and gypsum, the primary driving potential of the reaction. Temperature also affects the transfer rate of calcium and sulfate ions from the anhydrite lattice to the gypsum lattice. This effect is the result of change of ionic mobility, solution viscosity and the extent of solvation of the ion species. An equation is derived for the reaction rate as a function of temperature:

$$\frac{dC_g}{dt} = k_T \frac{\Lambda_T \eta_T \Delta}{\Lambda_{25} \eta_{25}}$$

where Λ represents the conductance of calcium sulfate at saturation, η the solution viscosity and Δ the solubility differential. Calculated data compare favorably with experimental data.

The accelerator salt increases sulfate ion adsorption on the gypsum surface which aids growth. From precipitation studies the reaction rate should be a function of supersaturation:

$$\frac{dC_g}{dt} = k_c \left[\left(\left[Ca^{++}\right]\left[SO_4^{=}\right] \right)^{1/2} - \left(\left[Ca^{++}\right]\left[SO_4^{=}\right] \right)_{sat.}^{1/2} \right]^6$$

An additional factor, the diminuition of solvent by solvation must be included: $\delta = \frac{55.5 - 15\,M}{55.5}$ where M is the molarity of Na_2SO_4. Calculations made using these two factors give results in accord with experimental data.

Other ions have been studied as accelerators:

Al^{+++}, Be^{++}, Cd^{++}, Co^{++}, Cs^{+}, Cu^{++}, Fe^{++}, Fe^{+++}, H^{+}, Li^{+}, Mg^{++}, Mn^{++}, NH_4^{+}, Ni^{++}, Rb^{+}, UO_2^{++}, Zn^{++}

and

$B_4O_7^{=}$, Br^{-}, CH_3COO^{-}, Cl^{-}, ClO_3^{-}, ClO_4^{-}, F^{-}, $Fe(CN)_6^{-4}$, $HCOO^{-}$, I^{-}, IO_4^{-}, MnO_4^{-}, NO_3^{-}, OH^{-}, $S_2O_3^{=}$, organic compounds and sea water. Acceleration correlates with ionic potential of the cation and activity coefficient of the salt.

The mechanism is postulated as follows: the reaction progresses by hydration and diffusion of calcium and sulfate ions from the anhydrite surface, transference through solution and adsorption and precipitation on the gypsum surface. Gypsum growth occurs by consumation of its adsorbed ion layers.

The reaction is irreversible and direct precipitation

of anhydrite is unlikely. The reaction is nearly quantitative in 2-3 hours and under proper conditions could be made commercial. Microfilm $2.05; Xerox $7.20. 154 pages.

CHEMISTRY, ORGANIC

SYNTHESES OF AMINO SUGARS AND AMINO ALDITOLS

(L. C. Card No. Mic 59-356)

Robert Krick Armstrong, Ph.D.
The Ohio State University, 1958

A convenient method has been developed for the synthesis of a variety of amino compounds in the sugar series. This method is based on the reduction of the carbohydrate hydrazine derivatives.

Hydrogenation of the readily available monosaccharide phenylhydrazones, using Raney nickel catalyst at 3 atmospheres pressure, has provided amino alditols. 1-Amino-1-deoxy-D-arabinitol, 1-amino-1-deoxy-D-galactitol and 1-amino-1-deoxy-D-gulitol have been prepared by this method. The synthesis of a new class of compounds, the diamino-dideoxyalditols, has been achieved by the reduction of the phenylhydrazone of 2-amino-2-deoxy-D-glucose to provide 1,2-diamino-1,2-dideoxy-D-glucitol. The reduction of D-arabino-hexose phenylosazone with palladium on charcoal catalyst, in the presence of hydrochloric acid, provided the isomeric 1,2-diamino-1,2-dideoxy-D-mannitol. All of these compounds have been isolated as crystalline salicylaldehyde Schiff bases, and some of them have been further characterized as their hydrobromide and N-(2,4-dinitrophenyl) derivatives.

The p-tolylsulfonyl derivatives of carbohydrates have been converted to the corresponding amino sugars through the reduction of hydrazino intermediates. These intermediates were formed through the facile replacement of the sulfonyloxy group by hydrazine. The following amino sugars have been prepared by this method: 3-amino-3-deoxy-1,2:5,6-di-O-isopropylidene-α-D-glucofuranose, methyl 6-amino-6-deoxy-3,4-O-isopropylidene-α-D-galactopyranoside, 5-amino-5-deoxy-1,2-O-isopropylidene-α-D-xylofuranose, 3,5-diamino-3,5-dideoxy-1,2-O-isopropylidene-α-D-xylo(?)-pentofuranose, methyl 2-amino-2-deoxy-3,5-O-isopropylidene-D-xylo(?)-pentofuranoside and methyl 2-amino-2-deoxy-3,4-O-isopropylidene-β-D-(and L-) arabino(?)-pentopyranoside. These amino sugars have been isolated from the reaction mixture as their salicylaldehyde Schiff bases or p-toluenesulfonate salts. The latter enantiomorphous compounds, methyl 2-amino-2-deoxy-3,4-O-isopropylidene-β-D-(and L-)arabino(?)-pentopyranoside, have been hydrolyzed to the corresponding methyl glycosides and then to the 2-amino-2-deoxy-pentoses which were isolated as their crystalline hydrochloride derivatives. These pentosamines exhibit the color tests and characteristic properties established for hexosamines.

The arabinose configurations have been assigned to these 2-amino-2-deoxy-pentoses on the assumption that the direct replacement of the p-tolylsulfonyl group by hydrazine is not accompanied by a Walden inversion.

The preparation of 3,5-diamino-3,5-dideoxy-1,2-O-isopropylidene-α-D-xylo(?)-pentofuranose represents the first synthesis of a diamino sugar derivative.

Microfilm $2.00; Xerox $4.60. 90 pages.

REACTIONS OF BZ-NITROQUINAZOLINE DERIVATIVES

(L. C. Card No. Mic 58-7831)

Joseph A. Cogliano, Ph.D.
Princeton University, 1958

As theory predicted, a reaction similar to that believed undergone by 4-methylthio-6,7-diphenylpteridine in the presence of methyl iodide and base to form 3-cyano-5,6-diphenylpyrazine has been found to occur in the 6-nitroquinazoline series. The formation of 2-amino-5-nitrobenzonitrile occurred upon addition of base to an aqueous dioxane solution of 4-methylthio-6-nitroquinazoline. Whenever alcohol was used as solvent for the reaction, however, displacement of the 4-methylthio group occurred to give a 4-alkoxy-6-nitroquinazoline. With t-butanol, however, only 6-nitro-4-quinazolone was obtained, probably because of the ready elimination of isobutylene from the molecule.

The presence of bulky groups on the sulfur atom did not aid in the formation of the nitrile by preventing attack at the 4 position as was expected. 4-Benzylthio-6-nitroquinazoline when reacted with base in methanol solution formed the 4-methoxy compound. 4-Triphenylmethylthio-6-nitroquinazoline when reacted in benzene solution with methanol, t-butanol, or phenol gave 4-mercapto-6-nitroquinazoline indicating that the point of attack by the nucleophilic agent is at the exocyclic carbon attached to the sulfur atom.

An attempt to obtain trimethyl 4-(6-nitro-quinazolinyl) ammonium iodide by the reaction between methyl iodide and 4-dimethylamino-6-nitroquinazoline gave, instead, 1-methyl-4-dimethylamino-6-nitroquinazolinium iodide. This compound when reacted with methanolic sodium methoxide yielded 1-methyl-4,4-dimethoxy-6-nitro-1,4-dihydroquinazoline. Refluxing of the former compound with stock methanol, and addition of dilute acid to the latter compound gave 1-methyl-6-nitro-4-quinazolone which could be cleaved by base to 2-methylamino-5-nitrobenzamide.

A study of the effect of resonance upon stabilization of the reaction intermediates indicated that reaction of the 3-benzyl derivatives of 6- and 8-nitro-4-quinazolones with nucleophilic agents would result in cleavage of the pyrimidine ring to give 2-amino-5- and 2-amino-3-nitro-N-benzylbenzamide, respectively. It was expected that the nitro groups in 3-benzyl-5- and -7-nitro-4-quinazolones would be displaced by the nucleophilic group.

Reaction of the 3-benzyl derivatives of the isomeric 5-, 6-, 7-, and 8-nitro-4-quinazolones with methylamine and n-butylamine, however, gave the corresponding nitro-N-benzylbenzamides in each case. 3-Benzyl-5-nitro-4-quinazolone gave the substitution products, 3-benzyl-5-methylamino-4-quinazolone and 3-benzyl-5-n-butylamino-4-quinazolone, in addition to cleavage product.

With methanol as solvent, displacement of the group at the 3 position occurred upon reacting ammonia and methylamine with 3-benzyl-6-nitro-4-quinazolone. For example, reaction of the 3-benzyl derivative with methylamine gave 3-methyl-6-nitro-4-quinazolone and 2-amino-5-nitro-N-methylbenzamide.

The facility with which the nitro group could be displaced from 3-benzyl-5-nitro-4-quinazolone was again shown by the formation of the 5-phenylthio derivative upon its reaction with sodium thiophenoxide. None of the other isomers gave the corresponding phenylthio compounds with this reagent. The 8-nitro isomer gave cleavage product while the 6- and 7-nitro isomers gave their cleavage products and unidentified high-melting compounds.

Reaction of the 3-benzyl derivatives of 5-, 6-, 7-, and 8-nitro-4-quinazolones with aqueous sodium methoxide or with sodium phenoxide in methanol caused cleavage of the pyrimidine ring with the 6- and 8-nitro isomers and replacement of the nitro group by the methoxy group with the 5- and 7-nitro isomers. 3-Benzyl-7-nitro-4-quinazolone when reacted with aqueous base, however, gave cleavage of the pyrimidine ring to give 4-nitroanthranilic acid.

Reactions analogous to those obtained with the benzyl derivative have been obtained with 3-methyl-7-nitro-4-quinazolone.

A mechanism which is consistent with the above cleavage reactions involves attack by the nucleophilic agent at C2 with consequent stabilization of the intermediate by N1 and by the nitro group followed by fission of the C2-N3 link. In reactions with base in aqueous methanol and with amines, subsequent hydrolysis of the fission product leads to the formation of 2-amino-Bz-nitro-N-benzylbenzamide. In the reaction between 3-benzyl-6-nitro-4-quinazolone and methylamine in methanol it is believed that following fission of the C2-N3 link the intermediate formed, 2-(3-methylformamidino-)-5-nitro-N-benzylbenzamide, undergoes recyclization to form 3-methyl-6-nitro-4-quinazolone.

Microfilm $2.00; Xerox $7.20. 152 pages.

SYNTHESIS OF 5-ALLYL-5-SUBSTITUTED HYDANTOINS

(L. C. Card No. Mic 59-187)

Tom Forest Davenport, Jr., Ph.D.
The University of Texas, 1957

Supervisor: Henry R. Henze

Diallylcadmium was prepared by the action of anhydrous cadmium chloride on an ether solution of allylmagnesium bromide. The treatment of the organocadmium compound with acyl chlorides, or anhydrides, did not produce the desired allyl ketones in satisfactory amount, but gave esters. For example, propionyl chloride or propionic anhydride gave a very low yield of allyl ethyl ketone while the major product was identified as 4-(4-ethylhepta-1,6-dienyl) propionate. Butyric anhydride gave some allyl propyl ketone and an ester identified as 4-(4-propylhepta-1,6-dienyl) butyrate. The infrared absorption spectra of these compounds were determined.

A series of 5-allyl-5-substituted-hydantoins was prepared in order to be tested for possible hypnotic and anticonvulsant activity. The hydantoins were prepared by the action of an alkaline solution of potassium hypobromite on the appropriate allyl cyanoacetamides, which were themselves prepared from the interaction of the sodio-derivative of the monosubstituted cyanoacetamide and allyl bromide. The monosubstituted cyanoacetamides were obtained either by a simultaneous condensation-reduction reaction between an aldehyde and ethyl cyanoacetate followed by ammonolysis of the resulting ester, or by the interaction of the sodio-derivative of ethyl cyanoacetate and an alkyl halide. alpha-Phenylcyanoacetamide is an exception, since it was formed by carboethoxylation of phenylacetonitrile followed by ammonolysis.

The results of the interaction of diallylcadmium and acyl chlorides, or anhydrides, are discussed with respect to the formation of the cadmium reagent and the proof of structure of the unexpected products. Three esters described in this work are previously unreported, as are six of the allyl cyanoacetamides and six of the allyl hydantoins.

Microfilm $2.00; Xerox $5.00. 100 pages.

A PHYTOCHEMICAL INVESTIGATION OF DELPHINIUM BARBEYI HUTH AND A STRUCTURAL INVESTIGATION OF THE ALKALOID DELTALINE

(L. C. Card No. Mic 58-7918)

James Peter Ferris, Ph.D.
Indiana University, 1958

A PHYTOCHEMICAL INVESTIGATION OF DELPHINIUM BARBEYI HUTH

Ten alkaloids were isolated by chromatography from the basic extract of the species Delphinium barbeyi Huth in this work. Deltaline and lycoctonine, two bases which had been previously isolated from D. barbeyi, were again isolated. Delpheline, delcosine and delphoccine are alkaloids isolated in this work that were previously isolated from other species of Delphinium. Two derivatives of deltaline, deltamine and dehydrodeltamine, were also isolated along with two unidentified ketones and one unidentified anthranoyl derivative.

The isolation of dehydrodeltamine and the two unidentified ketones is the first instance of the isolation of ketones from any species of Delphinium.

A STRUCTURAL INVESTIGATION OF THE ALKALOID DELTALINE

The olefin, desoxydehydrodeltaline, formed by loss of the elements of water from deltaline, was prepared by the action of thionyl chloride on deltaline, by the pyrolysis of acetyldeltaline, and by the dehydrohalogenation of chloroacetyldelpheline.

Desoxydehydrodeltaline can be catalytically hydrogenated with the absorption of one mole of hydrogen, to give acetyldelpheline. The apparent base strength of desoxydehydrodeltaline (pKa' 3.8) was found to be considerably less than that of its corresponding saturated derivative, acetyldelpheline (pKa' 5.4), a behavior analogous to allyl amines. This suggests that the double bond of desoxydehydrodeltaline is located beta-gamma with respect to the nitrogen atom. The tertiary hydroxyl group of deltaline, from which the double bond of desoxydehydrodeltaline was formed, must therefore be located in a position that is beta or gamma with respect to the nitrogen atom of deltaline.

The ultraviolet spectrum of the lactam derivative of

desoxydehydrodeltaline, desoxydehydro-oxodeltaline, indicates that the double bond present in the lactam is not in conjugation with the carbonyl group of the lactam.

The acetoxyl group of desoxydehydrodeltaline can be saponified, analogously to the saponification of deltaline to deltamine, to form desoxydehydrodeltamine. The ultraviolet spectrum of desoxydehydrooxodeltaminone, the keto-lactam formed by the oxidation of desoxydehydrodeltamine with chromic anhydride, indicates that the double bond present in the keto-lactam is not in conjugation with the ketone group.

The secondary hydroxyl group of delpheline can be methylated with sodium hydride and methyl iodide to form O-methyldelpheline. Acid hydrolysis of the methylenedioxy acetal group of O-methyldelpheline yielded desoxylycoctonine, identical with a sample prepared from lycoctonine. Assuming no unexpected rearrangements took place this interrelationship proves that lycoctonine and delpheline have the same carbon skeleton and differ from each other only in the number and nature of some of their oxygen functions.

Demethylenedeltamine, a tetrahydroxy base formed from deltamine by acid hydrolysis, was found to consume two moles of periodic acid due to the presence of a vicinal triol grouping in the molecule. The periodic acid oxidation of demethylenedeltamine was reinvestigated in this work and the product of the oxidation, Base D, was isolated. Analysis of this derivative indicated that it differed from demethylenedeltamine by having four less hydrogen atoms. The infrared spectrum of Base D indicated that there are no hydroxyl groups present in the molecule. A band at 1780 $cm.^{-1}$ suggested the presence of a gamma-lactone grouping, and an intense band at 1712 $cm.^{-1}$ suggested the presence of two carbonyl groups. Partly from other data it is inferred that one is an aldehyde and the other a ketone.

It was impossible to accommodate the chemical data concerning the tertiary hydroxyl group of deltaline with the carbon skeleton proposed for lycoctonine on the basis of an X-ray crystallographic investigation. New partial structures were suggested for deltaline, delpheline and lycoctonine based on chemical evidence alone.

Microfilm $2.50; Xerox $8.80. 191 pages.

THE CELLODEXTRINS; THEIR β-D-ACETATES AND ALDITOLS

(L. C. Card No. Mic 59-375)

Donald Lee Fields, Ph.D.
The Ohio State University, 1958

Previous studies conducted from the Ohio State University Chemistry Laboratory have described the isolation and characterization of a polymer-homologous series of α-D-oligosaccharide acetates from cellulose, complete from α-D-glucopyranose pentaacetate through α-cellohexaose eicosaacetate, as well as the unsubstituted sugars resulting from the deacetylation of these acetates. The isolation of the oligosaccharide acetates, from a partial acetolysis of cellulose, was effected by extrusion column chromatography on silicate adsorbents.

In continuing the investigation of these oligosaccharides, a polymer-homologous series of β-D-oligosaccharide acetates from cellulose, complete from β-cellobiose octaacetate through β-cellohexaose eicosaacetate, has been obtained and characterized. The acetates were prepared from their anomers by a stereospecific conversion reaction entailing the successive reaction of the α-D-acetate with hydrogen bromide and mercuric acetate in acetic acid solution.

The crystallinity of both the α-D and β-D-oligosaccharide acetates was examined by photomicrography. The crystallinity of both series decreases with increasing chain length, but from photomicrography considerations, this effect appears to be more pronounced in the α-D-acetate series. The rotatory powers of the six anomeric pairs of acetates follow the Hudson isolation rules and the Freudenberg relationship. β-Cellopentaose heptadecaacetate and β-cellohexaose eicosaacetate are new compounds.

A polymer-homologous series of crystalline alditols from cellulose, complete from cellobiitol through cellohexaitol, were also obtained and characterized. They were prepared from their respective aldoses by reduction with hydrogen and Raney nickel at high pressure. Cellopentaitol and cellohexaitol crystallized as monohydrates, and cellobiitol crystallized in both anhydrous and monohydrate forms. All of these members, with the exception of the disaccharide, are previously uncharacterized compounds.

In the course of this investigation, an improved column chromatographic procedure, utilizing Micro-Cel C as a new adsorbent, was adopted for the resolution of a cellulose acetolyzate into the polymer-homologous series of α-D-oligosaccharide acetates. Micro-Cel C is a synthetic calcium silicate manufactured by the Johns-Manville Co. of New York, N. Y. Polymorphism was encountered in this α-D-acetate series and is described.

X-ray powder diffraction data for the cellodextrins, from β-cellobiose through cellohexaose, their corresponding α-D and β-D-acetates, and their alditols are recorded, and possible inferences that might be made on orders of crystallinity of the series are discussed in the light of the x-ray studies. Microfilm $2.05; Xerox $7.20. 155 pages.

THE REACTION OF ALLYLSUCCINIC ANHYDRIDE WITH BENZENE

(L. C. Card No. Mic 59-448)

Trevor Bruce Hill, Ph.D.
Cornell University, 1958

The reaction of allylsuccinic anhydride with benzene afforded several acidic products, three of which have been separated by distillation of their methyl esters and identified. These are methyl 4-methyl-1-tetralone-2-acetate (I), 3-phenyl-5-carbomethoxycyclohexanone (II) and methyl α-phenacyl-γ-phenylvalerate (III).

The methyl α-phenacyl-γ-phenylvalerate (III) was hydrolyzed and reduced to α-(β-phenethyl)-γ-phenylvaleric acid. This acid was intramolecularly cyclized to give 2-(2-phenylpropyl)-1-tetralone and/or 2-(β-phenethyl)-4-methyl-1-tetralone. The tetralone mixture was reduced to the corresponding tetralols which were cyclodehydrated to afford 5-methyl-5,6,6a,6b,7,8-hexahydrobenzo[c]phenanthrene. The hydrocarbon was dehydrogenated to 5-methylbenzo[c]phenanthrene.

In order to prove the structure of the tetraloneacetic ester (I), the hydroxymethylene derivative of 4-methyl-1-tetralone was alkylated with ethyl bromoacetate and the resultant methyl 4-methyl-1-tetralone-2-acetate was compared with (I).

The structure of 3-phenyl-5-carbomethoxycyclohexanone (II), originally thought to be the isomer (III), was established by degradation to 3-phenylcyclohexanecarboxylic acid which was independently synthesized. This synthesis involved the reduction of 1-phenylcyclohexene-3-one to 3-phenylcyclohexanol. The alcohol was converted to the bromide and homologated by the Grignard method to give 3-phenylcyclohexanecarboxylic acid.

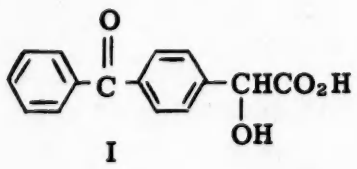
Microfilm $2.00; Xerox $6.20. 130 pages.

I. SOME STUDIES IN ASYMMETRIC SYNTHESIS AND ASYMMETRIC INDUCTION. II. THE SYNTHESIS OF NEW SUBSTITUTED ARYL GLUCOSIDES.

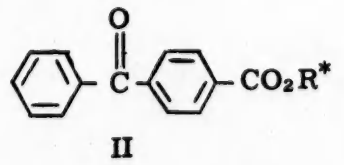
(L. C. Card No. Mic 59-274)

Mary Janet Kubitschek, Ph.D.
Stanford University, 1958

Several semicritical experiments have been attempted in the hope of shedding light on the mechanism of asymmetric synthesis, and in particular on the existence or non-existence of an asymmetric inductive effect caused by a stereospecific polarization of a keto group by a nearby center of fixed asymmetry in an optically active molecule. Assuming that such an electronic effect would be transmitted through a conjugated system, we have undertaken to synthesize a molecule in which a keto group is conjugated with an asymmetric carbon atom, then, by appropriate reactions, to create a new asymmetric center at the site of the keto group. For this purpose p-benzoylmandelic acid (I) has been synthesized. The projected study encompasses the resolution of I, followed by the introduction of a new center of asymmetry into the molecule by reduction of the carbonyl group or addition of a Grignard reagent thereto, followed then by destruction of the original center of asymmetry in the product, and examination of the latter for optical activity. Similar reactions have been undertaken with (-)-menthyl p-benzoylbenzoate (II), a vinylog of an α-keto ester, in order to study the inductive effect in a system more closely paralleling that with which McKenzie achieved his well-established asymmetric syntheses.



I



II

(R^* = (-)-menthyl)

p-Benzoylmandelic acid (I) has been prepared in larger overall yields by a new and shorter synthetic route. Reactions of optically active I with lithium aluminum hydride, sodium borohydride, and methylmagnesium iodide were inconclusive because of the intractible sirups which were obtained as the reaction products. Reactions of (-)-menthyl p-benzoylbenzoate (II) with the above reagents, followed by saponification of the ester products in the last two cases, has demonstrated that an asymmetric inductive effect is not transmitted through the benzene ring.

In duplication of the procedure of McKenzie, (-)-atrolactic acid has been synthesized by the reaction of (-)-menthyl benzoylformate with methylmagnesium iodide followed by alkaline hydrolysis of the product. Reduction of (-)-menthyl benzoylformate with lithium aluminum hydride led to the formation of D-(-)-phenylglycol. The latter has also been prepared in slightly higher optical purity by first reducing (-)-menthyl benzoylformate with sodium borohydride to (-)-menthyl mandelate containing a slight preponderance of the 1-diastereomer, followed by further reduction with lithium aluminum hydride to D-(-)-phenylglycol. Optically pure L-(+)- and D-(-)-phenylglycol for comparison purposes have been prepared by reduction of L-(+)- and D-(-)-mandelic acid.

II. THE SYNTHESIS OF NEW SUBSTITUTED ARYL GLUCOSIDES

Although aryl β-D-glycosides are readily prepared by the Koenigs-Knorr reaction or the Helferich-Schmitz-Hillebrecht synthesis, the corresponding α-anomers are not generally available. Preparation of the α-anomers by the Helferich-Schmitz-Hillebrecht procedure gives an α, β-mixture from which the desired α-anomer is frequently inseparable. Our interest, therefore, has been to prepare substituted aryl glycosides by direct reaction at the aromatic nucleus of unsubstituted aryl glycosides which may more often be obtained in both anomeric forms. In this manner 1-bromo-2-naphthyl tetraacetyl-β-D-glucoside has been synthesized and identified by hydrolysis, isolation and characterization of the aglucon. 1-Nitro-2-naphthyl tetraacetyl-β-D-glucoside has also been prepared by direct nitration of 2-naphthyl tetraacetyl-β-D-glucoside, and the position of the nitro group has been established by hydrolysis and characterization of the aglucon.

The position of the bromine atom in 4-bromo-1-naphthyl tetraacetyl-β-D-glucoside and of the nitro group in 4-nitro-1-naphthyl tetraacetyl-β-D-glucoside have likewise been established by hydrolysis and characterization of the aglucons. The latter glucosides were prepared during an earlier phase of this research.

Attempts have been made to prepare other aromatic glucosides by acylation and mercuration of the aromatic nucleus of the fully acetylated glucosides. These attempts have been unsuccessful.

Microfilm $2.10; Xerox $7.40. 160 pages.

STUDIES ON PERIODATE OXIDATION PRODUCTS OF CARBOHYDRATES

(L. C. Card No. Mic 58-2172)

Bertha Ann Lewis, Ph.D.
University of Minnesota, 1957

An investigation of the chemical and physical properties of the dialdehydes derived from several sugar glycosides by periodate oxidation revealed that the dialdehydes possess cyclic structures. Hydrogenation in the presence of palladium-charcoal of the dialdehydes

D'-methoxy-D-hydroxymethyl diglycolic aldehyde and L'-methoxy-D-hydroxymethyl diglycolic aldehyde derived from methyl α- and β-D-glucopyranoside respectively, by periodate oxidation, effected preferential reduction of one carbonyl group to give the corresponding monoaldehydes, D'-methoxy-2-glyceryloxy-acetaldehyde and L'-methoxy-2-glyceryloxy-acetaldehyde, whose structures were ascertained by oxidation with bromine-water to the corresponding monocarboxylic acids.

This selective reduction is explained on the basis of a 1,4-dioxane structure in which the carbonyl group corresponding to C_2 of the parent glycoside is involved in acetal formation with the primary hydroxyl group. Consequently, the dialdehydes derived from methyl α- and β-D-glucopyranoside should now be designated 2-D(L)-methoxy-6-aldehydo-1,4-dioxane-3-ol and the monoaldehydes derived from them as 2-D(L)-methoxy-6-hydroxymethyl-1,4-dioxane-3-ol.

The dialdehydes L'-methoxy-L-methyl-diglycolic aldehyde, D'-methoxy-D-methoxymethyl-diglycolic aldehyde and D'-methoxy-diglycolic aldehyde derived from methyl α-L-rhamnopyranoside, methyl 6-O-methyl-α-D-galactopyranoside and methyl β-L-arabopyranoside respectively, were not affected by hydrogenation in the presence of palladium-charcoal. For this reason a 1,4-dioxane structure has been proposed for these dialdehydes in which the two carbonyl groups are mutually engaged in hemiacetal ring formation.

Several of the dialdehydes exhibit mutarotation as a result of isomerization at the new asymmetric centers produced by cyclic acetal formation. Likewise, all of the dialdehydes investigated have relatively high rotations, a characteristic of cyclic systems.

Support for the cyclic structure was provided by the observation that the dialdehyde L'-methoxy-L-methyl diglycolic aldehyde and the dialdehyde derived from methyl 4,6-benzylidene-α-D-glucopyranoside were readily converted into crystalline di-p-nitrobenzoates as was the monoaldehyde L'-methoxy-2-glyceryloxy-acetaldehyde. The dialdehyde produced from methyl 4,6-benzylidene-α-D-glucopyranoside was reduced with sodium borohydride to the corresponding dihydric alcohol which was characterized as the crystalline di-p-nitrobenzoate and as the methylated derivative.

Treatment of the monoaldehyde, D'-methoxy-2-glyceryloxy-acetaldehyde, with methanolic hydrogen chloride generated two isomeric acetals that could be resolved by chromatography.

A method employing glass paper electrophoresis and a 2 N sodium hydroxide electrolyte has been developed to study the heterogeneity of polysaccharides.

Microfilm $2.00; Xerox $4.80; 95 pages.

ORGANOSILYLMETALLIC COMPOUNDS AND DERIVATIVES

(L. C. Card No. Mic 59-1139)

Glen Dale Lichtenwalter, Ph.D.
Iowa State College, 1958

Adviser: Henry Gilman

The formation and reactions of organosilylmetallic compounds have been investigated.

In the formation of such compounds, the use of tetrahydrofuran as a solvent was found to be useful. Triphenylsilyllithium, obtained in this solvent by the cleavage of hexaphenyldisilane with lithium, was quite stable over extended periods of time. In addition, methyldiphenylsilyllithium and dimethylphenylsilyllithium were prepared successfully in this solvent by the lithium cleavages of the corresponding symmetrical disilanes.

Attempted formation of organosilylmetallic compounds containing different metals through the reactions of metallic halides with triphenylsilyllithium was not successful.

The reactions of organosilyllithium compounds with primary and secondary amines to give silylamines are described. Thiosilanes were readily prepared by the reaction of triphenylsilyllithium with sulfur, followed by the addition of reactive organic halides. Triphenylsilyllithium was found to add to acridine in the 9,10-positions to give 10-lithio-9-(triphenylsilyl)acridan. Further reactions of this intermediate are described. Disilanes were cleaved by silyllithium compounds to give new disilanes and less reactive silyllithium compounds.

Microfilm $2.00; Xerox $5.60. 111 pages.

THE GAS CHROMATOGRAPHIC STUDY OF THE COOL FLAME AND MOTORED ENGINE COMBUSTION OF SOME HYDROCARBONS

(L. C. Card No. Mic 59-401)

Henry Robert Menapace, Ph.D.
The Ohio State University, 1958

The oxidation of hydrocarbons as a source of energy has become increasingly important with the wider use of internal combustion engines in modern society. In spite of the many years of study of this process, it is still not completely understood.

Gas chromatography has been employed as an analytical tool in the present research to determine fuel and oxygen consumption and to measure the amounts of oxygenated products of combustion. Coupled with infrared spectroscopy, gas chromatography has been used to characterize unknown products of n-hexane combustion.

The work reported in this dissertation is concerned with the cool flame oxidation of n-hexane, blends of n-hexane and 1-hexene, and blends of n-heptane and 2-heptene. Studies were also made on the combustion of blends of n-hexane and 2,3-dimethylbutane and blends of isooctane and diisobutylene in a motored engine. As a corollary to the above investigation, two alkyl hydroperoxides were prepared and decomposed. Attempts were made also to

prepare 2,5-dihydro-2,5-dimethylfuran, which was believed to produce the unknown curves of one of the gas chromatograms.

The results and/or conclusions obtained follow:

Gas chromatography is capable of rapidly giving reasonably accurate and reproducible analytical data for the low molecular weight oxygenated products of n-hexane, n-heptane and their olefinic counterparts.

Four compounds have been found which are new products with respect to the cool flame combustion of n-hexane. They are ethylene oxide, propylene oxide, methyl vinyl ketone, and 2-ethlytetrahydrofuran.

The versatility of the "peroxide theory" first described in detail by Walsh has been demonstrated by its extension to account for the above products.

The decompositions of 2- and 3-hydroperoxyhexane have shown that these hydroperoxides are capable of yielding many of the products observed in the cool flame oxidation of n-hexane.

The extraordinary resistance of 2,5-dimethylfuran to common reducing agents, such as sodium in liquid ammonia and sodium amalgams, has been noted.

Some evidence for chemical interaction between the components of blends and/or among their oxidation products has been presented and discussed.

Some correlations have been made between the combustion curves for the blends studied and their antiknock characteristics. Two of the blends, n-hexane/2,3-dimethylbutane and n-heptane/2-heptene, were antagonistic (performance numbers less than those calculated). The outstanding relationship was the very low conversion to carbon dioxide of the initiated fuels of the antagonistic blends and the nearly complete conversion of the initiated fuels of the synergistic blend. On this basis, the blend n-hexane/1-hexene should also exhibit antagonistic characteristics.

The cause of knock in an engine has been tentatively ascribed to the rapid detonation or combustion of partially oxidized fragments in the fuel-air mixture just ahead of the main flame front in the cylinder. These fragments are believed to be produced by the premature reaction of low-octane components in the fuel blend.

Microfilm $2.00; Xerox $6.00. 124 pages.

THE SYNTHESIS OF 1-BROMOBENZO[C]PHENANTHRENE

(L. C. Card No. Mic 59-414)

Donald Kenney Phillips, Ph.D.
The Ohio State University, 1958

The synthetic routes to the benzo[c]phenanthrene ring system from 1954 through Chemical Abstracts, 1956, (and several syntheses reported later) are reviewed. Previous syntheses have been reviewed by A. I. Kosak [Ph.D. Dissertation, The Ohio State University, 1948], through 1947, by M. Wolf [Ph.D. Dissertation, The Ohio State University, 1951] through 1950, and by R. M. Wise [Ph.D. Dissertation, The Ohio State University, 1955].

The synthesis of 1-bromobenzo[c]phenanthrene in 14.3% yield in eleven steps from o-bromobenzaldehyde (I) is described. Condensation of ethyl cyanoacetate with I afforded ethyl o-bromobenzalcyanoacetate (II) in 91.2% yield. Addition of phenylmagnesium bromide to II yielded ethyl o-bromobenzhydrylcyanoacetate (III) in 90.7% yield. Hydrolysis of III with 25% potassium hydroxide in ethanol yielded o-bromobenzhydrylmalonic acid (IV) in 84.0% yield. Esterification of IV with diazomethane yielded the dimethyl ester (V) in 88.1% yield. Lithium aluminum hydride reduction of V afforded 2-(o-bromobenzhydryl)-1,3-propanediol (VI) in 91.7% yield. The diol (VI) was converted to 3-(o-bromobenzhydryl) glutaric acid (VII) in 70.3% yield by conversion of VI to the bis-methanesulfonate, followed by replacement of the ester groups with cyanide and alkaline hydrolysis of the dinitrile to VII. Double cyclization of VII with polyphosphoric acid afforded 6a,12b-dihydro-1-bromobenzo[c]phenanthrene-5,8(6H,7H)-dione (VIII) in 67.8% yield. Lithium aluminum hydride reduction of VIII afforded the corresponding diol (IX) quantitatively. The diol (IX), when refluxed with a catalytic amount of iodine in xylene for 120 hours yielded 1-bromobenzo[c]phenanthrene (XII) in 53.6% yield.

Treatment of X with cuprous cyanide in N-methyl-2-pyrolidone afforded 1-cyanobenzo[c]phenanthrene (XII) in 71.0% yield.

Condensation of diethyl malonate with I yielded diethyl o-bromobenzalmalonate (XIII) in 88.0% yield. Addition of phenylmagnesium bromide to XIII afforded diethyl o-bromobenzhydrylmalonate (XIV) in poor yield. Lithium aluminum hydride reduction of XIV yielded VI.

Condensation of malononitrile with I yielded o-bromobenzalmalononitrile (XV). Addition of phenylmagnesium bromide to XV afforded o-bromobenzhydrylmalononitrile (XVI). Microfilm $2.00; Xerox $5.00. 97 pages.

STUDIES IN RING B OF THE PREGNANE NUCLEUS: THE FAVORSKII REARRANGEMENT AND THE CHEMISTRY OF 5,6-EPOXIDES

(L. C. Card No. Mic 58-7664)

Alex Thomas Rowland, Ph.D.
Brown University, 1958

In view of the significant changes in physiological activity which result from certain structural alterations of naturally occurring steroids, a program was undertaken to prepare B-norpregnane derivatives in order to compare the biological action of these compounds with that of the normal hormones.

The method which was studied as a means of preparing the B-norpregnanes was the Favorskii rearrangements of α-haloketones. The first α-haloketone to be studied was 6-bromo-7-keto-allopregnan-3β,20β-diol diacetate (mixture of epimers at carbon 6), which was prepared in several steps from pregnenolone acetate. The reaction of this α-haloketone with sodium ethoxide in absolute ethanol gave 7-keto-Δ^5-pregnen-3β,20β-diol diacetate and 7-keto-allopregnan-3β,6,20β-triol triacetate (mixture of epimers at carbon 6). No trace of a ring-contraction product was found.

The preparation and reactions of two 5,6-oxides in the pregnane series were studied in order to determine the utility of these compounds as intermediates in the preparation of α-haloketones.

One oxide, 5,6β-epoxy-pregnan-3β,20β-diol diacetate, was converted into 5-chloro-6-keto-allopregnan-3β,20β-diol diacetate, which upon reaction with sodium ethoxide in absolute ethanol yielded what was believed to be 5-carbethoxy-B-norpregnan-3β,20β-diol diacetate and 6-keto-pregnan-3β,5,20β-triol 3,20-diacetate. Thus, this α-halo-ketone underwent ring contraction when treated with base, while the 6-bromo-7-keto steroid originally mentioned did not undergo rearrangement.

The isomeric oxide, 5,6α-epoxy-allopregnan-3β,20β-diol diacetate, was converted to allopregnan-3β,5,6β,20β-tetrol 3,20-diacetate. The tetracetate devised from the latter compound was reacted with base to yield 5,6β-epoxy-pregnan-3β,20β-diol, which was converted by acetylation to the aforementioned oxide, 5,6β-epoxy-pregnan-3β,20β-diol diacetate. The latter reaction thus represents a novel preparation of β-oxides, which are produced in low yield by the epoxidation of Δ^5-steroids. The generality of this reaction was shown by the conversion of cholestan-3β,5,6β-triol triacetate to a β-oxide, cholesterol-β-oxide; cholestan-3β,5,6β-triol was also isolated as a by-product.

The catalytic reduction of 5,6,β-epoxy-pregnan-3β,20β-diol diacetate gave rise to hydrogenolysis products, allopregnan-3β,20β-diol diacetate and allopregnan-20β-ol acetate. None of the expected product, allopregnan-3β,6β,20β-triol 3,20-diacetate, could be isolated in crystalline form.

The catalytic reduction of 5,6α-epoxy-allopregnan-3β,20β-diol diacetate yielded mainly allopregnan-3β,5,20β-triol 3,20-diacetate and a small amount of a hydrogenolysis product, allopregnan-3β,20β-diol diacetate. A mechanism is proposed to explain the anomalous reduction of these oxides. Microfilm $2.10; Xerox $7.40. 160 pages.

A STUDY OF SOME FIVE-MEMBERED OXYGEN HETEROCYCLES

(L. C. Card No. Mic 59-426)

Carl Henry Snyder, Ph.D.
The Ohio State University, 1958

A brief study has been made of the effect of reaction conditions on the yield of the Diels-Alder adduct of furan and vinylene carbonate. A good conversion of vinylene carbonate to adduct has been obtained at the expense of yield.

9,10-Dihydro-9,10-ethano-11,12-methylenedioxyanthracene (III) has been prepared in 92% yield by reaction of 9,10-dihydro-9,10-ethanoanthracene-cis-11,12-diol with paraformaldehyde in refluxing benzene. Anthracene and a small amount of olefinic material have been obtained from an attempted preparation of dioxole by pyrolysis of III.

Evidence has been obtained for the formation of 4,5-dimethylene-1,3-dioxolane (V) by pyrolysis of d-4,5-bis-(dimethyloxyaminomethyl)-1,3-dioxolane (XXIII). Compound XXIII has been prepared by the following sequence of reactions. Reaction of diethyl d-tartrate with paraformaldehyde in refluxing benzene has given diethyl d-1,3-dioxolane-4,5-dicarboxylate (XVI) in 25% yield. N,N,N',N'-Tetramethyl-d-1,3-dioxolane-4,5-dicarboxamide (XXI) has been prepared from XVI by two routes. After three days at room temperature, a mixture of XVI and dimethylamine has given 57% of XXI. Also, saponification of XVI to disodium d-1,3-dioxolane-4,5-dicarboxylate (XIX), preparation of d-1,3-dioxolane-4,5-bis-(carbonyl chloride) (XX) by refluxing a mixture of XIX and thionyl chloride, and addition of XX to an ethereal solution of dimethylamine has given XXI in 42% overall yield. d-4,5-Bis-(dimethylaminomethyl)-1,3-dioxolane (XXII) has been prepared in 69% yield by reduction of XXI with lithium aluminum hydride in tetrahydrofuran. Oxidation of XXII with hydrogen peroxide has given XXIII in 97% yield. Pyrolysis of XXIII has given V in a calculated yield of 50%. Although isolation of V has not been achieved because of difficulties encountered in the removal of dimethylhydroxylamine from the pyrolysate, the structure of V has been confirmed by hydrogenation of the hydrocarbon-soluble portion of the pyrolysate to 4,5-dimethyl-1,3-dioxolane. Additional evidence for the presence of V in the pyrolysate has been obtained from spectroscopic analysis of the hydrocarbon-soluble portion of the pyrolysate and from reactions of products obtained on hydrolysis of the pyrolysate.

Attempts to purify V and to obtain a Diels-Alder adduct of V with N-phenylmaleimide have been described.

The preparation of N,N,N',N'-tetramethyl-d-tartramide (XVIII) and the attempted preparation of XXI from XVIII have been described. Finally, the preparation of d-4,5-bis-(hydroxymethyl)-1,3-dioxolane diacetate (XXV) and the attempted preparation of V by pyrolysis of XXV have been described. Microfilm $2.00; Xerox $5.20. 101 pages.

CHEMISTRY, PHARMACEUTICAL

SYNTHESIS OF SOME AMIDES OF GENTISIC ACID

(L. C. Card No. Mic 59-369)

Allen I. Dines, Ph.D.
The Ohio State University, 1958

Salicylic acid and sodium salicylate have been used for many years as analgetics. In the body, salicylic acid is biologically oxidized to gentisic acid.

Salicylic acid amide also has found its place in medicine as a useful analgetic agent and is used in place of the free acid. This amide also undergoes biological oxidation in the body and gives gentisic acid amide. In recent years this oxidation product has been found to possess analgetic activity.

Some recent work on salicylic acid derivatives as analgetic agents has shown that N-substituted amides of salicylic acid have analgetic activity. The compound obtained by the introduction of a methoxyl group in the 5 position of salicylamide, 5-methoxysalicylamide, possesses analgetic activity comparable to that obtained with salicylamide. In addition, the methyl ether of salicylamide, 2-methoxybenzamide, also possesses analgetic activity; and N-methyl gentisic acid amide is another synthetic analgetic.

Because of the analgetic activity found in the above salicylamide and gentisic acid amide derivatives, this research was directed toward the preparation of some

N-substituted amides of gentisic acid. The dimethyl ether of gentisic acid, 2,5-dimethoxybenzoic acid, was used as the fundamental acid, since the resulting N-substituted amide would be less susceptible to oxidation and may be less toxic.

Twenty-two N-substituted amides of 2,5-dimethoxybenzoic acid were prepared by the action of the acid chloride of this acid with various amines which alone or in chemical combination have been shown to possess analgetic or depressant activity.

The compounds prepared may be classified as the N-monosubstituted amides of 2,5-dimethoxybenzoic acid, N-disubstituted amides of 2,5-dimethoxybenzoic acid, and miscellaneous amides of 2,5-dimethoxybenzoic acid.

By correlating the nitrogen analyses and the infrared absorption bands found for these compounds, their proposed structures were confirmed.

Microfilm $2.00; Xerox $6.60. 138 pages.

CHEMISTRY, PHYSICAL

PYRRHOTITE---PYRITE EQUILIBRIUM RELATIONS BETWEEN 325° AND 743° C.

(L. C. Card No. Mic 58-7814)

Ralph G. Arnold, Ph.D.
Princeton University, 1958

The structure, cell constants, composition, vapor pressure of pyrrhotite solid solutions are reviewed. The cell constants, metal/sulfur ratio of pyrite are discussed.

All synthesis, except as otherwise noted, was done in sealed, evacuated silica glass tubes with vapor present. Philips powder cameras (Straumanis film mounting; 114.59 mm diameter) utilizing iron radiation were used for X-ray work. Iron and sulfur, 99.93 and 99.993 per cent pure, respectively, were the starting materials. All pyrrhotites had a normal hexagonal symmetry. Pyrrhotite compositions are expressed in atomic per cent Fe.

A d(102) lattice spacing-composition curve was constructed from pyrrhotites synthesized at 800° and 600°C. Corrections were made for sulfur loss to vapor where necessary. The pyrrhotite (102)α was measured to the quartz (200)α reflection to ± 0.03° 2θ. The curve passes through the following points. The first and second numbers are pyrrhotite compositions and the d(102) in Å (±0.0009 Å), respectively: 50.00/2.0915, 49.37/2.0873, 48.72/2.0807, 48.00/2.0728, 47.50/2.0683, 47.37/2.0677, 47.00/2.0620, 46.67/2.0583, 46.50/2.0575, 46.20/2.0525, 46.15/2.0512, 46.00/2.0501, 45.89/2.0481. Pyrrhotite compositions may be measured to ±0.09 using this curve.

The limit of pyrrhotite solid solution was determined from 325° to 650°C at vapor pressures of a fraction mm Hg to 150 mm Hg, respectively. Coexisting pyrrhotite and pyrite were synthesized and pyrrhotite compositions measured by the lattice spacing composition method. At 650°, 600°, 520°, 450°, 400°, 325°C the equilibrium pyrrhotite compositions were 45.83, 46.03, 46.42, 46.83, 47.06, 47.24, respectively. Pyrite cell dimensions were all within a = 5.417 ± 0.002 Å.

The limit of pyrrhotite solid solution at 1000 and 2000 bars external pressure was done in sealed collapsible gold tubes. At 2000 bars and 325°, 400°, 520°, 600°C, pyrrhotite compositions were 47.24, 47.08, 46.70, 46.46, respectively. At 1000 bars and 523° and 605°C the compositions were 46.58 and 46.18, respectively. Cell dimensions of coexisting pyrite were within a = 5.419 ± 0.002 Å. The constancy of all pyrite cell dimensions indicates a constant metal/sulfur ratio within the limit of error of measurement.

Above 650°C the limit of pyrrhotite solid solution was bracketed (in silica tubes) by runs of specific bulk composition (corrected for sulfur loss to vapor) which, (1) contained pyrite with pyrrhotite (sulfur side), (2) contained only pyrrhotite (iron side). Method of measuring equilibrium pyrrhotite compositions was abandoned, since pyrrhotites quenched from above 650°C exsolved pyrite during cooling. At 698° and 736°C runs containing 45.23 and 44.89 atomic per cent Fe contained pyrite; at 708°, 736°, and 731°C runs containing 45.27, 45.04 and 45.02 atomic per cent Fe consisted of only pyrrhotite. The uncertainty in the limit of solid solution is ±0.10 atomic per cent Fe. This curve representing the limit of solid solution terminates at 743°C where pyrrhotite, pyrite, liquid and vapor (invariant assemblage) may coexist in equilibrium at 12 atm vapor pressure. Above 743°C pyrite can melt incongruently to pyrrhotite and a liquid rich in sulfur.

Pyrrhotites richer in sulfur than 45.65 atomic per cent Fe and rapidly quenched from above 666°C showed a lamellar phase oriented in four directions, up to 3 μ wide and 50 μ long, having a reflectivity between that of pyrrhotite and pyrite. Its X-ray powder pattern is unlike that of known iron sulfides. Its symmetry, composition and field of stability are not known; however, the evidence suggests that it is a metastable phase.

Experiments indicate that water has no effect on the pyrrhotite-pyrite equilibrium. Structural effects of substituting cobalt and nickel for iron on stoichiometric pyrrhotite were studied. Cobalt was found to replace iron and fill iron vacancies simultaneously in nonstoichiometric pyrrhotite.

Minimum temperatures of formation of natural pyrrhotites coexisting with pyrite were determined at 2000 bars. Pyrrhotite compositions were determined using the d(102) spacing-composition relation. Temperatures obtained ranged from 425° to 560°C. Requirements for the application of the experimental results to natural assemblages are discussed. Microfilm $2.00; Xerox $5.40. 108 pages.

THE THERMODYNAMIC ACTIVITY OF CADMIUM IN MAGNESIUM-CADMIUM ALLOYS

(L. C. Card No. Mic 58-7823)

Richard J. Borg, Ph.D.
Princeton University, 1957

The vapor pressure of solid cadmium has been determined as a function of temperature using the orifice effusion method. The technique employed is believed to achieve better temperature control than the measurements reported previously in the literature. The "chemical constant" calculated from these data is in better agreement

with the theoretical value than those of any previous measurement.

The cadmium vapor pressure was determined as a function of temperature for five solid cadmium-magnesium alloys of varying composition. Activity coefficients were calculated for each measurement. These results compare favorably with activities determined by other workers using the e.m.f. method. When this alloy has approximately the composition Mg_4Cd_6 a sudden change in the axial ratio of the unit cell occurs. This change has been attributed to a change in the types of Brillouin Zone faces which are overlapped by the Fermi energy sphere. The alloy compositions studied were chosen so as to bracket the region wherein this change takes place. A sharp increase in activity was found at the appropriate composition. Unfortunately the number of measurements is still insufficient to warrant the conclusion that this sudden increase in free energy is unequivocally established.

Microfilm $2.00; Xerox $5.20. 103 pages.

THE ELECTRON MAGNETIC RESONANCE AND INFRARED SPECTRA OF OF LOW-TEMPERATURE CARBONS

(L. C. Card No. Mic 58-7824)

Thomas H. Brown, Ph.D.
Princeton University, 1957

In this investigation the electronic properties of low-temperature carbons have been studied, in particular, the electron magnetic resonance and infra-red spectra.

The starting material for this investigation was anhydrous D-glucose. The bulk of the samples were prepared by the following procedure. D-glucose was preliminarly charred in air at a temperature less than 300° C. This material was further heated to various temperatures for more than eight hours, either in vacuum or nitrogen.

The electron magnetic resonance yielded the following information. The total number of unpaired electrons appears to increase with charring temperature up to 570° C. Thereafter, the number of unpaired electrons appears to decrease. The width of the absorption line, which is initially constant, reaches a minimum value of less than one gauss at 570° ± 10° C. The line width then increases rapidly.

The effects of O_2, NO, H_2, and N_2 on the resonance absorption were as follows. H_2 and N_2 showed no observable effect. O_2 and NO appreciably broadened the absorption line and appeared to decrease the total number of unpaired electrons.

The infra-red spectra of D-glucose and a series of charcoals of charring temperatures up to 2800° C were determined in the range of 2 to 15.5 microns. The potassium bromide mounting technique was used.

The initial stages of the charring process were followed by comparing the spectrum of a sample heated to 235° C with the spectrum of D-glucose. The absorption bands characteristic of the α-pyranose ring structure of D-glucose were not present in the 235° charcoal. The sharp absorption peaks present in the range of 7 to 10 microns were replaced by a broad absorption band. A new absorption band was found at 6.25 microns.

For a sample heated to 333° C, the band at 6.25 microns was found to increase in intensity. There was also an absorption throughout the region 2 to 15.5 microns. For samples heated to higher temperatures, the absorption was approximately constant throughout this region.

The absorption coefficient for the carbon samples, determined as a function of charring temperature, increased with charring temperature until 600° C, decreased slightly until 800° C, and then rose gradually until 2200° C. Above this temperature the absorption coefficient increased rapidly until at 2800° C the value approached that measured for Achesson graphite.

By comparing the ultraviolet, visible, and near infra-red spectra of these carbons with the spectra measured for evaporated carbon films, the presence of a leading edge characteristic of a semi-conductor was found. It was concluded that the absorption found from 0.2 to 2 microns and the constant absorption found from 2 to 15.5 microns was due to electronic transitions.

For temperatures up to 600° C, the major portion of the absorption is due to transitions associated with impurities and electron transfer processes. With increasing charring temperature, absorption is due to excitation of electrons to the conduction band, the previous two types of transitions becoming less important at higher charring temperatures. The increase in the absorption coefficient with higher temperatures has been associated with the growth and ordering of the graphite crystallites.

Results of measurements of resistivities and Hall coefficients of carbons have been reviewed and have been used with the results of the measurements reported here to give a model for the electronic structure of these carbons. The uncertainties in the results of these other electronic properties and the questionable applicability of such measurements to the samples used in this investigation severely limit the validity of this treatment. However, it is believed that the treatment given here is illustrative, at least, of the type of analysis which must be used in order to understand the electronic properties of low-temperature carbons. Microfilm $2.00; Xerox $4.40. 83 pages.

SOME APPLICATIONS OF QUANTUM AND STATISTICAL MECHANICS TO CHEMICAL PROBLEMS

(L. C. Card No. Mic 59-705)

Morton Albert Eliason, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Joseph O. Hirschfelder

The thesis consists of five parts, each of which deals with the application of quantum or statistical mechanics to some problem of chemical interest.

In part one approximate natural spin orbitals and the corresponding occupation numbers are obtained for the $^1\Sigma$ ground state and the $^3\Sigma$ excited state of the hydrogen molecule. These are obtained for a wide range of internuclear separations using the Hirschfelder-Linnett wave functions as a basis for the calculation. The occupation numbers are the squares of the expansion coefficients in the natural expansion of the wave function. Tables of

these coefficients are given and their variation with internuclear separation is discussed in terms of electronic configurations. For the $^1\Sigma$ state a comparison is made with the corresponding expansion coefficients derived from the Wang wave function.

The second part of the thesis deals with the kinetics of bimolecular, gas phase, chemical reactions. A collisional approach somewhat similar to the Wang-Chang and Uhlenbeck treatment for the transport properties of polyatomic molecules is used to obtain a general expression for the rate in terms of a reaction cross-section.

Specialization is then made to the case where a Maxwell-Boltzmann velocity distribution can be assumed for the reactants. This leads to a relation between the rate constants for reaction of molecules in definite internal quantum states and the reaction cross-sections which involves Laplace transforms. The further assumption of a Boltzmann distribution among the internal energy states of the reactant molecules then leads to a rate equation of the usual form and to an explicit expression for the single rate constant. This expression is used to rederive the results of the old "simple" collision theories.

Finally, a collisional approach is used to rederive the usual rate expression of the Eyring theory of absolute reaction rates. The rather drastic approximations which seem to be necessary for such a derivation are pointed out and discussed.

Part three gives a method for the high speed computation of overlap integrals between Löwdin orbitals on different centers. These overlap integrals, which are the expansion coefficients needed for the expansion of a set of orbitals on one center in terms of a set centered at some other point, are to be calculated through the use of recursion relations from a set of starting values which are obtained by the zeta function method of Barnett and Coulson.

An explicit program for the computation is given, written in the language of the automatic coding system, Fortran. Appendices give a method and Fortran program for the computation of certain generalized Gaunt coefficients

$$U\begin{pmatrix} o & m & m \\ j & i & k \end{pmatrix} = \int_{-1}^{1} P_j(x)\, P_i^m(x)\; P_k^m(x)\, dx$$

and tables of these coefficients for the ranges of the indices: $0 \leq m \leq 9$; $0 \leq j \leq 18$; and $m \leq i,k \leq 9$.

The fourth part, in the form of a reprint from the Proceedings of the National Academy of Sciences, Vol. 42, 546-559 (1956), describes the calculation of some molecular collision integrals for point attraction and repulsion potentials. These integrals, which are useful for the calculation of transport properties of gases with inverse power interactions, are given for repulsive potentials with inverse square and cube dependence on separation, and for attractive potentials with inverse square, cube, and sixth power dependence.

The final part of the thesis, a reprint from the Annals of the New York Academy of Sciences, Vol. 67, 451-461 (1957), deals with methods for the estimation of transport properties for electronically excited atoms and molecules. It is shown how collision diameters may be estimated, first on the basis of the sizes of electronic orbitals, and in a somewhat better manner from a knowledge of the potential energy of interaction. Tables are provided which make possible reasonable estimates for the transport properties of atoms and molecules in excited electronic states. Microfilm $2.20; Xerox $7.80. 167 pages.

STUDIES ON THE KINETICS OF VINYL POLYMERIZATION AND ON THE PREPARATION AND STRUCTURE OF DIENE POLYMERS

(L. C. Card No. Mic 58-7840)

Thomas E. Ferington, Ph.D.
Princeton University, 1957

Thiuram sulfides have been studied as to their action in the polymerizable compounds methyl methacrylate and styrene. Tetramethylthiuram disulfide (TMTD) has been studied at 60°, 70°, 80° C in methyl methacrylate. At low concentrations it has a purely initiating activity, while as the concentration increases a retarding effect becomes more important, Over this temperature range the initiating effect is described by the relation:

$$\frac{R_i'}{[cat]} = 4.80 \times 10^{14} \exp\left(\frac{-31.6 \text{ kcal}}{RT}\right)$$

It is surprising that this equation falls in the same range as the equivalent one for e.g. benzoyl peroxide

$$\frac{R_i'}{[cat]} = 3.99 \times 10^{14} \exp\left(\frac{-30.0 \text{ kcal}}{RT}\right)$$

since one would ordinarily expect the S-S bond to be much stronger than the O-O bond. The retarding effect, which persists to lower temperatures, was studied at 30° C in the presence of azobisisobutyronitrile. Retardation is found to be due to radical attack on the TMTD molecule. Evidence on the photo activity of TMTD was also obtained. Various polar reagents were studied as to their effect on the rate of generation of radicals by TMTD but no pronounced change was found. A comparison with vulcanization data for TMTD indicates similar primary steps in vulcanization and polymerization by this compound.

Tetramethylthiurammonosulfide (TMTM) was studied in the same way as TMTD at 70°, 80°, 90° C. No retardation was found. The experimental points for initiation were fit by the equation

$$\frac{R_i'}{[cat]} = 9.0 \times 10^{10} \exp\left(\frac{-29.4 \text{ kcal}}{RT}\right).$$

The energy of activation is very similar to that for TMTD. Experimental observations on the photo-activity of TMTM are given.

Dipentamethylenethiuramtetrasulfide was found to have a purely retarding behavior with methyl methacrylate.

Diphenyldisulfide, while much less active than TMTD shows a very similar combination of initiating and retarding ability at 100° C.

A mechanism is presented which fits the above observations. Retardation is due to polysulfide radical species RS_x. ($x > 1$) and initiation occurs through the intermediate radical $RS\cdot$. In the case of thiuram compounds this latter is unstable and further decomposes to $CS_2 + (CH_3)N\cdot$. This mechanism is consistent with most of the observed data on thiuram vulcanization.

Butadiene has been polymerized by $AlCl_3$ and related materials at -78°C. The structure of the polymers produced has been studied by infra-red analysis. The structure of the soluble polybutadiene was found to be independent of extent of conversion, concentration of catalyst solution, and length of reaction. An insoluble polymer also

also formed in the system and the amount of this depended on the extent of conversion, being greater at higher conversion whether this was achieved by higher catalyst concentration or longer time. Complexing the $AlCl_3$ with nitroethane or nitrobenzene changed the structure of the polymer slightly, while the use of diethyl ether as a complexer produced no changes. $TiCl_4$, used as the initiator, produced polymers of slightly different structures from those formed with $AlCl_3$, while $AlBr_3$ and $BF_3 \cdot Et_2O$ yielded polymers like those from $AlCl_3$. When the solvent used was varied the polymer structure also varied. The observed variations were small in all cases.

Values of A' and $C_{tr,M}$ for methyl methacrylate polymerization between 20^0 and 98^0 C are given. Comments are made on similar results later presented by U.S.Nandi.

Microfilm $2.00; Xerox $5.20. 105 pages.

I. THE RAMAN SPECTRUM AND STRUCTURE OF THE AQUEOUS SILICATE ION. II. A KINETIC STUDY OF THE OXIDATION OF BROMIDE ION BY PEROXYMONOSULFURIC ACID.

(L. C. Card No. Mic 58-7643)

Donald Holly Fortnum, Ph.D.
Brown University, 1958

I

The Raman spectrum of the aqueous silicate ion was obtained. The results were found to be consistent with the modified tetrahedral structure, $SiO_2(OH)_2^{--}$, and inconsistent with other proposed structures. Raman and infrared spectra of some possible structural analogues were obtained. Force constants for the symmetrical stretching vibrations of several oxyanions and their fluorine substituted analogues were calculated.

II

A kinetic study of the oxidation of bromide ion by peroxymonosulfuric acid (Caro's acid) was made using colorimetric techniques. The data indicated the following rate law for the reaction:

$$\frac{-d(HSO_5^-)}{dt} = k\,(HSO_5^-)\,(Br^-).$$

At an ionic strength of 0.2, the rate constant was found to be 1.04 ±.04, 0.48 ±.02, and 0.22 ±.02 $(moles/liter)^{-1}(seconds)^{-1}$ at 25.0^0C, 12.9^0C, and 1.2^0C respectively. The temperature dependence of the rate constant gave enthalpy and entropy of activation values of 10.0 kcal./mole and -24.3 e.u./mole respectively. A mechanism involving the nucleophilic attack of bromide ion on the caroate ion, HSO_5^-, is postulated.

Microfilm $2.00; Xerox $4.40. 82 pages.

PROPERTIES OF GASEOUS FREE RADICALS

(L. C. Card No. Mic 59-379)

Philip Lincoln Hanst, Ph.D.
The Ohio State University, 1958

Part A - The Oxidation of Methyl Radicals at Room Temperature.

Methyl radicals were produced by photolysis of azomethane. Infrared analysis showed that in the presence of oxygen these radicals reacted to produce, as major products, methanol and formic acid, and as lesser products, formaldehyde, carbon monoxide and possibly dimethyl peroxide. Methyl hydroperoxide and peroxy formic acid were not detected. Experiments with additives and studies of the properties of possible intermediates also yielded data which were useful in determining the free radical reactions taking place. The important reactions appear to be the following: $CH_3 + O_2 \rightarrow CH_3OO$, $CH_3OO + O_2 \rightarrow CH_3O + O_3$, and $CH_3O + CH_3O \rightarrow CH_3OH + H_2CO$; the formaldehyde is further oxidized to formic acid. The results also indicate that the reactions $2CH_3OO \rightarrow 2CH_3O + O_2$ and $CH_3OO + RH \rightarrow CH_3OOH + R$ are probably not important in this system.

Part B - Experiments on Photochemical Oxidation and their Implications Concerning the Photochemistry of Atmospheres Polluted with Auto Exhaust.

The fact that ozone forms in the room-temperature gaseous photo-oxidation of certain organic compounds is well established. Presented here is experimental evidence which helps in the formulation of the mechanisms of this ozone formation in the important cases of oxidation of methyl radicals, photolysis of diacetyl in oxygen, and photolysis of nitrites in oxygen. The mechanisms deduced lead to a reconsideration of certain aspects of the photochemistry of atmospheres polluted with auto exhaust. It is proposed that the "Compound X" of Los Angeles "smog" has the formula $R\overset{O}{\overset{\|}{C}}ONO$ (acyl nitrite) instead of $R\overset{O}{\overset{\|}{C}}OONO$ (peroxy acyl nitrite), and that the major portion of the ozone in the "smog" is produced in reactions of hydrocarbon free radicals rather than from nitrogen dioxide generated in a cyclic photolysis of "peroxy acyl nitrites."

Part C - The Thermal Decomposition of Dimethyl Peroxide: The Oxygen-Oxygen Bond Strength of Dialkyl Peroxides.

Dimethyl peroxide was decomposed in a static system at various temperatures, with products being measured by infrared absorption spectroscopy. The decomposition is unimolecular and approximately follows the stoichiometry $2CH_3OOCH_3 \rightarrow 3CH_3OH + CO$. The fact that the decomposition proceeds via methoxy radicals was proved by the addition of nitric oxide which led to the formation of methyl nitrite as the only major product. The presence of oxygen did not alter the decomposition seriously, although it did lead to the production of some formic acid and formaldehyde. An Arrhenius plot of the data gave an activation energy (CH_3O-OCH_3 bond strength) of 35.3 ± 2.5 kcal/mole, which is in good agreement with the values obtained by other investigators for dimethyl peroxide and some of its homologues. Three sets of published data on the thermal

decomposition of diethyl peroxide were combined in a composite Arrhenius plot to give an activation energy of 34.1 kcal/mole. This value is in fair agreement with the activation energies of decomposition of homologous dialkyl peroxides, whereas the values obtained separately in the three investigations are anomalously low.

Microfilm $2.00; Xerox $4.00. 75 pages.

A KINETIC STUDY OF THE LOW-TEMPERATURE GAS-PHASE OXIDATION OF CYCLOHEXENE IN A STATIC SYSTEM

(L. C. Card No. Mic 59-380)

George Hunt Hembree, Ph.D.
The Ohio State University, 1958

The gas phase reaction between oxygen and cyclohexene has been studied in a static system at 230° and 250° C. Measured quantities of the reactants were admitted to an evacuated quartz flask, and the course of the reaction was followed by measuring the change in pressure on a mercury manometer and by removing samples of the reacting mixture for analysis.

During reactions of mixtures in which the initial pressure of oxygen was equal to or greater than that of cyclohexene, the pressure decreased slowly to a minimum, then rose rapidly at an accelerating rate, passed through a maximum rate, and increased slowly to a steady value. Increasing the diameter of the reaction vessel increased the maximum rate of pressure change and the total pressure change, but decreased the induction period, defined as the time elapsed before the pressure began to increase, only slightly. Added nitrogen decreased the induction period and increased the maximum rate of pressure change, but had no effect on the total pressure change.

Products of the reaction which have been identified include carbon monoxide, carbon dioxide, water, methane, ethylene, benzene, formaldehyde, acetaldehyde, acrolein, acetone, cyclohexene 1-one, ethylene oxide, methanol and hydrogen peroxide. Other peroxidic materials were formed during the reaction and probably included 3-cyclohexenyl hydroperoxide. The carbonyl products of the reaction contained an appreciable amount of material which appeared to be dicarbonyl or polyfunctional carbonyl compounds.

Unreacted oxygen and cyclohexene, and carbon monoxide, carbon dioxide, ethylene, benzene, ethylene oxide, acrolein, acetone and methanol were determined by gas chromatography. The total amount of peroxides was determined by iodometric titration. Hydrogen peroxide was determined polarographically. The total amount of carbonyl compounds in the product was determined by preparing the 2,4-dinitrophenylhydrazine derivatives and by reaction with hydroxylamine hydrochloride reagent. The 2,4-dinitrophenylhydrazine derivatives of formaldehyde, acetaldehyde and cyclohexene 1-one were separated by chromatographing on silicic acid adsorbent and their amounts determined spectrophotometrically.

Appreciable quantities of the reactants were consumed during the period of pressure decrease, and the subsequent pressure increase was due to oxidation of the products. Both peroxides and carbonyl products were formed early in the reaction. Their concentrations increased logarithmically with time, and reached maxima soon after the onset of rapid pressure increase. Carbon monoxide and carbon dioxide were the principal products of the reaction. The period of rapid formation of these products corresponded to the period of rapid decrease in the concentration of the total carbonyl products. The materials for which quantitative analysis was obtained account for approximately 52 per cent of the total number of moles of material present at the end of the reaction and 72 per cent of the carbon initially present as cyclohexene. A large part of the unaccounted-for material was water.

A mechanism has been proposed for the gas phase oxidation of cyclohexene which involves the formation of 3-cyclohexenyl hydroperoxide, the decomposition of this peroxide to higher aldehydes, and the subsequent oxidation and degradation of these aldehydes. The possibility of reactions involving the addition of radicals and oxygen to the olefinic bond and the possibility of a radical-induced polymerization of cyclohexene have also been considered.

Microfilm $2.00; Xerox $6.40. 133 pages.

A STUDY OF ADSORPTION PROCESSES OCCURRING AT AN IDEALLY POLARIZABLE ELECTRODE-SOLUTION INTERPHASE

(L. C. Card No. Mic 59-1132)

Donald Andrew Hickson, Ph.D.
Iowa State College, 1958

Supervisor: Robert S. Hansen

An investigation of the dependence of the impedance of the electrical double layer at a mercury-solution interphase upon polarization, frequency, temperature and adsorbate concentration of a capillary-active organic material (pentanol-1) was conducted and the possibilities of inferring adsorption parameters from such measurements were considered.

In order to facilitate the investigation of adsorption phenomena by this technique, an automatic impedance recording instrument was designed and constructed and the theory of the instrument response was developed. An unexpected frequency dispersion of the apparent capacity of the electrical double layer was observed at mercury-aqueous perchloric acid solution interphases.

A theory of dielectric relaxation within the electrical double layer was proposed to account for the observed frequency dispersion of the apparent double layer capacity. The assumption of two molecular species of water molecules within the compact region of the electrical double layer was demonstrated to be sufficient to explain this behavior. Each of these species was associated with a particular relaxation time which were found to be approximately 10^{-3} and 10^{-4} seconds, respectively, for the "bound" and "free" species of water molecules in the compact region of the double layer. Using these values for the relaxation times, the observed frequency dispersion of the apparent capacity was quantitatively explained. Results of a similar study at the mercury-aqueous potassium iodide solution interphase reported by Bockris and Conway could also be interpreted by a similar treatment. It was also

demonstrated that the effect of temperature upon the properties of the compact region of the electrical double layer can be interpreted on this basis.

It was shown that the frequency dispersion of the double layer impedance in the presence of a capillary active material can also be interpreted by an extension of the theory presented in the neighborhood of the electrocapillary maximum. The relaxation time of adsorbed pentanol-1 molecules was found to be about 6.8×10^{-4} seconds. Dielectric changes due to the concentration of adsorbate at the interphase necessary for a quantitative representation of the data were correlated with the observed surface coverages and were found to be physically reasonable.

The pronounced frequency dispersion of the apparent capacity at high polarizations in the presence of adsorbable materials was discussed in the light of a kinetic treatment of adsorption processes proposed by Frumkin and Melik-Gaikazyan. Diagnostic criteria representative of various rate controlling mechanisms were derived in terms of the instrument response and were applied to the inference of the rate controlling mechanism in the adsorption of pentanol-1 at the mercury-aqueous electrolytic solution interphase. The kinetic criteria proved not to be definitive in selecting the rate controlling step in the adsorption process using the experimental data available.

Conditions are discussed under which the electrical properties of the double layer at a polarizable electrode interphase can be represented by an equivalent analog circuit. The equivalent circuit concept was found to be applicable only if the applied periodic field across the double layer is a pure harmonic.

Microfilm $2.20; Xerox $7.80. 168 pages.

EXCHANGE AND CHEMICAL REACTIONS OF CYCLOPENTADIENYL COBALT COMPOUNDS

(L. C. Card No. Mic 59-1136)

Seymour Katz, Ph.D.
Iowa State College, 1958

Supervisor: A. F. Voigt

Chemical and exchange studies have been performed with the objective of elucidating some of the chemical characteristics of cyclopentadienyl cobalt compounds. Exchange studies on the system bis(π-cyclopentadienyl)cobalt(III) perchlorate-cobaltous perchlorate were conducted in aqueous solutions at 25°C. No exchange was observed in times up to 30 days which indicated the great stability and the covalent nature of metal-cyclopentadienyl ring bonding.

The apparent exchange of cobalt between bis(π-cyclopentadienyl)cobalt(II), $(C_5H_5)_2Co$, and bis(π-cyclopentadienyl)cobalt(III) perchlorate, $[(C_5H_5)_2Co]ClO_4$, was studied at 0°C in the virtual absence of air. The exchange was characterized by a relatively high zero time exchange (>0.5) which increased as a function of the bis(π-cyclopentadienyl)cobalt(II) concentration. The zero time exchange and the half time data could be quantitatively accounted for on the basis of the following equilibria:

$$(C_5H_5)_2Co + [(C_5H_5)_2Co^{60}]^+ \rightleftharpoons [(C_5H_5)_2Co]^+ + (C_5H_5)_2Co^{60} \quad \text{(very fast)} \qquad (1)$$

$$[(C_5H_5)_2Co^{60}]^+ + [(C_5H_5)_2Co]_2O \overset{k_1}{\rightleftharpoons} [(C_5H_5)_2Co^{60}] + [(C_5H_5)_2Co]O + [(C_5H_5)_2Co]^+ \quad \text{(slow)} \qquad (2)$$

$$(C_5H_5)_2Co^{60} + [(C_5H_5)_2Co]_2O \overset{k_2}{\rightleftharpoons} [(C_5H_5)_2Co^{60}] + [(C_5H_5)_2Co]O + (C_5H_5)_2Co \quad \text{(slow)} \qquad (3)$$

The presence of $[(C_5H_5)_2Co]_2O$ was attributed to the oxidation of a portion of the $(C_5H_5)_2Co$ by small amounts of oxygen contamination. The high zero time exchange is ascribed to reaction 1, the observed half times to reactions 2 and 3. The latter reactions both proceeding via second order kinetics i.e., first order in each of the reactants, in which $k_1 = k_2$ ($\overline{0.029}$ liter/mole sec).

A qualitative description of the complex reaction of bis(π-cyclopentadienyl)cobalt(II) with oxygen in mesitylene solutions was obtained. The first product formed in the reaction is believed to be bis(π-cyclopentadienyl)cobalt(III) hydroxide which decomposes on the further addition of one half mole of oxygen per mole of hydroxide. The products of this reaction appear to be cobaltous ions and a polymeric organic substance. Further reaction of the products with oxygen occurs but no attempt was made to characterize the products. The kinetics of the formation of the hydroxide could not be measured because the reaction was very rapid. However, all succeeding reactions were first order in cobalt compounds and zero order in oxygen.

A study was made of the reactions of bis(π-cyclopentadienyl)cobalt(II) with alkyl halides, in particular the reaction with carbon tetrachloride from which a new cyclopentadienyl-cobalt compound, $(C_5H_5)_2(CCl_3)Co$, was isolated. The properties of the new compound were studied in an effort to establish its structure and the type of metal-ring bonding present. Infra-red and chemical evidence indicated that one of the cyclopentadienyl rings as well as the trichloromethyl group are σ bonded to the cobalt. Since it is known that the cobalt-ring bonding in $(C_5H_5)_2Co$ is π in nature, the formation of the trichloromethyl compound involves a change from π to σ bonding with a corresponding rearrangement of structure. The reverse rearrangement was also noted; the σ bonded cyclopentadienyltrichloromethyl-cobalt compound was converted to the π bonded bis(π-cyclopentadienyl)cobalt(III) cation. From the reaction of bis(π-cyclopentadienyl)cobalt(II) with chloroform, a high yield of the trichloromethyl compound was obtained which led to the conclusion that a free radical mechanism was responsible for the formation of the compound.

Microfilm $2.00; Xerox $5.80. 120 pages.

THE PHYSICAL PROPERTIES AND INTERACTIONS OF SOME MINOR MILK PROTEINS

(L. C. Card No. Mic 59-397)

John Edward Long, Ph.D.
The Ohio State University, 1958

A calcium-soluble casein fraction and a calcium-precipitated casein fraction were obtained when a 2 - 3 per cent α-casein solution at pH 6.6 - 7.0 was made 0.20 M with respect to calcium ions.

The calcium-precipitated fraction, termed α_R-casein, presented one polydispersed component upon electrophoretic and ultracentrifuge analysis ($s_{20} = 4.6$) at pH 6.98

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

and 0.10 ionic strength. This fraction contained 1.16 per cent phosphorus and produced no visible reaction with rennet in the absence of calcium ions.

The calcium-soluble fraction, termed crude κ-casein, contained κ-casein (s_{20} = 13.2) and a heretofore unreported casein which was named λ-casein (s_{20} = 1.3). Crude κ-casein contained 0.46 ± 0.04 per cent phosphorus and in the absence of calcium was rapidly precipitated by rennet. Crude κ-casein protected α_R-casein against precipitation by calcium ions.

λ-Casein contained 1.18 per cent phosphorus and was not precipitated by calcium. However, at calcium concentration less than 100 mM, considerable turbidity was evident. The addition of rennet to a calcium-free solution produced no visible reaction.

The phosphorus content of κ-casein was less than 0.33 per cent.

β-Lactoglobulin interacted with crude κ-casein when a mixture of these proteins was heated at 65°C. and above. Electrophoretic analysis, at pH 6.5 and 0.10 ionic strength, indicated that the complex migrated at the same rate as κ-casein.

When a 1:1 mixture (by weight) of β-lactoglobulin and crude κ-casein was subjected to a 20-minute heating period, the amount of β-lactoglobulin which interacted was 3.4 per cent at 65°C., 83 per cent at 85°C., and 76 per cent at 99°C. A 1:1 mixture was heated at 85°C. or 99°C. for periods up to 20 minutes. The reaction at 99°C. was extremely rapid and reached an approximate maximum after 8 minutes, whereas the interaction at 85°C. proceeded at a slower rate but reached a higher percentage of interaction. These data indicated that the maximum interaction after an infinite period of heating at 85°C. or 99°C. would approach 100 per cent and 80 per cent, respectively. Apparently, some side reaction occurred at 99°C. which prevented complete interaction.

As the ratio of β-lactoglobulin to κ-casein was increased above the 1:1 level, the value of δ (grams of β-lactoglobulin interacted per gram of κ-casein) increased. δ increased from 0.81 at a 1β:1κ ratio to 1.56 at a 3β:1κ ratio. These data indicated that at an infinite ratio of β-lactoglobulin to κ-casein the value of δ would approach 2.20.

Experiments in which the proteins were heated individually indicated that β-lactoglobulin must be heated before an interaction would occur between this protein and κ-casein. Under these conditions, less interaction occurred than in the experiments in which the proteins were heated together. This was attributed to some configurational change which occurred upon cooling and before the mixing of one or both of the proteins.

When the proteins were heated separately the sedimentation constant of the interaction complex was 23 Svedbergs compared with 18 Svedbergs for the κ-casein. When the proteins were heated together, the sedimentation constant for a 1β:1κ and a 3β:1κ mixing ratio were 44 and 48 Svedbergs respectively.

Chemical analysis indicated that β-lactoglobulin interacted with a casein which had a phosphorus content of 0.20 - 0.30 per cent. This is in the range of the phosphorus content of κ-casein.

The observations in this study could not be accounted for in terms of a heat conversion of β-lactoglobulin to a fast electrophoretically migrating component.

Microfilm $2.00; Xerox $6.60. 138 pages.

THE MAGNETOCHEMISTRY OF SOME IRIDIUM COMPOUNDS

(L. C. Card No. Mic 59-54)

Vello Norman, Ph.D.
The University of North Carolina, 1958

Supervisor: J. C. Morrow, III

Magnetic susceptibility measurements were made on twelve iridium compounds over a temperature range from 78°K to about 300°K. The measurements were conducted by the Gouy method and by a modified Sucksmith method.

The susceptibilities of $(NH_4)_2IrCl_6$ and K_2IrCl_6 were found to obey the Curie-Weiss Law over the whole temperature range with Weiss constants of -93°K and -34°K respectively. The molar susceptibility of $(NH_4)_2IrCl_6$ is 1103×10^{-6} at 299°K and 244×10^{-6} at 78°K, and that of K_2IrCl_6 is 1131×10^{-6} at 298°K and 3277×10^{-6} at 81.5°K.

A plot of reciprocal susceptibility versus temperature for $(NH_4)_2IrBr_6$ shows a slight concave curvature toward the temperature axis, but it obeys the Curie-Weiss Law approximately between 195° and 300°K with a Weiss constant of -127°K. The susceptibility is 1290×10^{-6} at 300°K and 3104×10^{-6} at 78°K.

The susceptibilities of $(CH_3NH_3)_2IrCl_6$ and $(PyH)_2IrCl_6$ are 580×10^{-6} and 284×10^{-6} at 300°K. At 78°K the susceptibilities are 2211×10^{-6} and 3039×10^{-6} respectively. The susceptibilities can not be represented by the Curie-Weiss Law. $(\phi_4As)_2IrCl_6$ is diamagnetic at 300°K but has a susceptibility of 2633×10^{-6} at 78°K.

The susceptibility of $IrCl_4.3H_2O$ varies from 238×10^{-6} at 299°K to 1641×10^{-6} at 78°K and is representable by the Curie-Weiss Law between 195°K and 300°K with a Weiss constant of +116°K.

$IrO_2.2H_2O$ has a susceptibility of about 150×10^{-6} at 300°K and 420×10^{-6} at 78°K and a Weiss constant of the order of a few hundred degrees.

$KIrF_6$ was found to have a susceptibility of 4850×10^{-6} at 295°K and 5165×10^{-6} at 78°K. The susceptibility does not obey the Curie-Weiss Law.

$Ir(Py)_2Cl_4$, Sr_2IrO_4 and the supposedly divalent iridium compound $Na_6[Ir(SO_3)_4].10H_2O$ are diamagnetic over the whole temperature range.

It is shown that the lower than expected susceptibilities of $(NH_4)_2IrCl_6$ and K_2IrCl_6 are due to an antiferromagnetic interaction between neighboring iridium atoms. Kotani's equation for the variation of magnetic moment with temperature was found to be qualitatively useful in predicting the magnetic moments of the two compounds with spin-orbit coupling coefficients of about 4300cm^{-1} and 12,000cm^{-1}. The experimental observation of increasing magnetic moments in the series $IrF_6^=$, $IrCl_6^=$ and $IrBr_6^=$ is explained in terms of diminishing interaction as the Ir-Ir distance in the crystal increases.

The abnormal susceptibilities of $(CH_3NH_3)_2IrCl_6$, $(PyH)_2IrCl_6$ and $(\phi_4As)_2IrCl_6$ are explained as being probably due to an interaction of the cation with the magnetic iridium atom.

The observed susceptibility variation of $IrCl_4.3H_2O$ with temperature is explained in terms of partial hydrolysis of the compound.

$IrO_2.2H_2O$ is contrasted with the magnetically more concentrated IrO_2 and $IrSe_2$ and a comparison is made of the effect of magnetic dilution on spin quenching. It is

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suggested that the diamagnetism of Sr_2IrO_4 is possibly due to antiferromagnetism, often observed in compounds of similar nature.

The susceptibility of $KIrF_6$ was found to follow Kotani's theoretical equation very well, but interference from ferromagnetic impurities renders the results for this compound somewhat uncertain.

It is suggested that the empirical formula of the complex $Na_6[Ir(SO_3)_4].10H_2O$ is probably incorrect, and that the iridium in this case is trivalent rather than divalent.

The diamagnetism of $Ir(Py)_2Cl_4$ is ascribed to polymer formation. Microfilm $2.00; Xerox $6.20. 126 pages.

STUDIES IN DIELECTRIC BEHAVIOR AT MILLIMETER WAVELENGTHS, AND IN MOLECULAR SHAPE AND DIELECTRIC RELAXATION TIME

(L. C. Card No. Mic 58-7883)

Robert W. Rampolla, Ph.D.
Princeton University, 1957

The fundamental equations describing the propagation of plane waves in absorptive media are developed and discussed. An expression is obtained for the reflection coefficient for plane waves at oblique incidence on a plane dielectric sheet of finite thickness in terms of the thickness and electrical properties of the sheet. Equations are given for the analysis of experimental data in the case of both low and high loss media.

An apparatus has been constructed for the measurement of dielectric constants and losses of liquids at a wavelength of 3 millimeters using a free wave method. Millimeter energy is obtained by quadrupling the frequency of a K-band reflex klystron. A detailed account is given of the harmonic generator and detector, the antenna system and the dielectric cell. The probable error in dielectric constant measurements is found to be 0.5 per cent, while the error in loss measurements is estimated to be of the order of 2 to 5 per cent for high loss media. For extremely low loss media, only an upper limit for the loss can be obtained owing to the limited amount of harmonic energy which is available.

Various aspects of dielectric behavior, particularly dielectric relaxation, are presented and discussed. The phenomenon of a distribution of relaxation times and the effects of viscosity and internal field on relaxation time are considered. Methods used in the calculation of relaxation times are briefly described.

The dielectric constant and loss of ethylbenzene, p-chlorotoluene, chlorobenzene, 6- and 8-methylquinoline, methyl, ethyl and n-octyl alcohol and water have been measured at 3.12 mm. at 20°, and the results evaluated in terms of the existing lower frequency data on these compounds. The substituted benzenes and quinolines are observed to depart from the customary Cole-Cole plot at 3 mm. However, no conclusions can be drawn as to the cause of this departure. Water is found to conform to the Debye dispersion theory throughout the frequency spectrum, the 3 mm. data giving a critical wavelength of 1.88 cm. as compared to the accepted value of 1.78 cm. A critical wavelength of 0.44 cm has been found for the second, high frequency dispersion region in ethyl alcohol, while an evaluation of the results on n-octyl alcohol indicates the presence of a third dispersion region having a critical wavelength of 0.50 cm. Due to the lack of sufficient high frequency data on methyl alcohol, a significant calculation of the critical wavelength of the indicated second dispersion region cannot be made.

Dielectric constant and loss measurements at wavelengths of 1.25, 3.22 and 10.0 cm. and 300 meters have been carried out at 20, 40, and 60° on 1- and 2-methylnaphthalene, 1,2,3,4-tetrahydronaphthalene, 1-nitronaphthalene, 2-, 4-, 6-, and 8-methylquinoline and 2,4- and 2,6-dimethylpyridine in the pure liquid state, and also on 1-nitronaphthalene in dilute benzene solution. The relaxation times and viscosities are examined in relation to molecular size and shape. A change in the direction of the dipolar vector for similarly shaped, non-spherical molecules is found to have a marked effect on relaxation time but not on viscosity. A rough proportionality between relaxation time and viscosity is observed for molecules of not too different size and shape provided the direction of their dipolar vectors does not vary appreciably.

Microfilm $2.00; Xerox $5.00. 100 pages.

AN X-RAY DIFFRACTION STUDY OF THE CRYSTAL STRUCTURES OF CYANOACETYLENE, ETHYLENIMINE, AND THE CUBIC PHASE OF ICE

(L. C. Card No. Mic 58-7665)

Frank VanLoon Shallcross, Ph.D.
Brown University, 1958

Cubic ice was formed by condensation of water vapor onto surfaces at low temperature, but it was never obtained free of hexagonal ice. X-ray diffraction powder photographs were taken of cubichexagonal ice mixtures at -130°C and -190°C. They confirmed the diamond structure for the oxygen atoms in the cubic phase, previously inferred from electron diffraction data. No definite information could be obtained about the hydrogen positions. The lattice constant was found to be 6.37 Å at -190°C. Cubic ice samples underwent a phase transition to the ordinary hexagonal form when warmed to temperatures between -130°C and -75°C. The condensation rate and surface conditions apparently helped to determine the type of ice which formed on cold surfaces. Studies were also made on amorphous ice samples at -190°C.

Ethylenimine single crystals were studied by x-ray diffraction at about -100°C. The crystals were found to be triclinic, with six molecules in the unit cell. The cell dimensions are $a = 4.83$ Å, $b = 8.15$ Å, $c = 11.30$ Å, $\alpha = 76.1°$, $\beta = 85.8°$, $\gamma = 77.4°$. The experimentally observed density is 1.024 g/ml at about -195°C. A complete structure determination was not carried out on ethylenimine.

The crystal structure of cyanoacetylene was determined at -25°C. The unit cell is monoclinic, with dimensions $a = 6.96$ Å, $b = 6.30$ Å, $c = 3.84$ Å, $\beta = 110.5°$; the most probable space group is $P2_1/m$, with two molecules per unit cell. The structure was refined using Fourier methods. Cyanoacetylene molecules are joined together by $\equiv C\text{-}H \ldots N\equiv$ hydrogen bonds into approximately linear

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infinite chains parallel to a; the chains are nearly close-packed. The molecules are linear within the experimental error; the bond lengths are C≡N = 1.14 A, C-C = 1.38 A, C≡C = 1.18 A, C-H = 0.9 A, and C-H...N = 3.27 A. The hydrogen peak was located from difference density sections. Cyanoacetylene powders were examined at temperatures between -25°C and -160°C, but gave no indication of phase transitions.

Microfilm $2.50; Xerox $8.80. 191 pages.

COPPER, NICKEL, AND SOME OF THEIR ALLOYS AS CATALYSTS FOR ORTHO-PARA HYDROGEN INTERCONVERSION

(L. C. Card No. Mic 58-7666)

Phoebe Bailey Shallcross, Ph.D.
Brown University, 1958

The present study was undertaken in an effort to assess the importance of electronic, geometric, and other factors to the catalytic activity of the copper-nickel alloys as measured by catalysis of the ortho-para hydrogen interconversion. The catalysts were prepared by coprecipitation of copper and/or nickel carbonates, followed by reduction in hydrogen at temperatures up to 500°C. X-ray diffraction studies showed that the catalysts had the same lattice structures as metals and alloys prepared by melting techniques. Magnetic measurements indicated that the active granular catalysts were at least as homogeneous as the pellets prepared from them by melting and then annealing in helium at 900°C.

At -196°C the ortho to para hydrogen conversion by the copper-nickel catalysts was inhibited in every case when hydrogen was preadsorbed on the surface at 325°C. For the para to ortho reaction at -20°C, hydrogen preadsorbed at 325°C had a poisoning effect on the pure nickel catalyst and a promoting effect on the alloy catalysts. The activity of the pure copper catalyst was too small to determine at -20°C, and preadsorbed hydrogen had no effect on its catalytic activity at 60° to 110°C. The poisoning effect of preadsorbed hydrogen on the reaction at -196°C may be ascribed not only to a blocking of the surface, but also to a weakening of surface magnetic fields by pairing of metal d-band electrons with those from chemisorbed hydrogen. The effect of preadsorbed hydrogen on the reaction at -20°C is discussed in terms of various parameters. It is probable that the change in work function of the metal by preadsorbed hydrogen is important. Because of the complexity of the situation it is at present not possible to predict a detailed mechanism for the effect of preadsorbed hydrogen on either reaction.

The catalytic activity-composition relationship at -196° for surfaces which did not contain preadsorbed hydrogen was characterized by (i) a sharp decrease in activity upon the addition of 5% or less of copper to nickel; (ii) a region of essentially constant activity, extending from about 5 to 90% copper; and (iii) a further drop in activity to a very small value between about 90% and pure copper. The activity of surfaces which did contain preadsorbed hydrogen in all cases was too low to measure quantitatively at this temperature.

The catalytic activity-composition relationship at -20°C for surfaces which did not contain preadsorbed hydrogen was characterized by (i) a small drop in activity upon the addition of 5% or less of copper; (ii) a region extending from about 5 to 90% copper in which the activity decreased only slightly; and (iii) a large decrease in activity in the region from 90 to 100% copper. Although the specific magnetization and the density of states at the Fermi level decrease sharply at about 60 atom % copper, there are indications that some d-band holes persist up to high concentrations of copper. The fact that the catalytic activity drops sharply only when the alloys change from paramagnetic to diamagnetic near 95% copper is believed to be significant. Also, hydrogen adsorbed under reaction conditions is believed to be an important factor in the persistence of a high level of catalytic activity to 90% copper and above, even when deliberately preadsorbed hydrogen is absent.

It appears that adsorbed hydrogen, by modifying its own environment, can partially mask the effect of the electronic structure of the catalyst. Thus even for an apparently simple reaction the structure of the catalyst appears to influence catalysis somewhat indirectly through several types of hydrogen adsorption, which largely dictate the rate of the ortho-para hydrogen interconversion.

Microfilm $2.00; Xerox $5.00. 100 pages.

A STUDY OF THE METHYL-OXYGEN AND THE METHYL-NITRIC OXIDE REACTIONS BY FLASH PHOTOLYSIS

(L. C. Card No. Mic 59-425)

William Clifford Sleppy, Ph.D.
The Ohio State University, 1958

The flash photolysis of azomethane was studied in experiments with added inert gases and either oxygen or nitric oxide. The data from the oxygen-free and nitric oxide-free systems indicate that a few (less than 1 per cent) of the methyl radicals formed in the flash photolysis of azomethane are energy rich and abstract hydrogen rapidly unless they are thermally equilibrated by inert gas. The unimportance of the possible transient species, CH_3N_2, in this system is indicated. From the experiments with added oxygen, the reaction, $CH_3 + O_2 + M \rightarrow CH_3O_2 + M$ (1), is shown to be third order, and the rate constant for 25° is derived and found to be $k_1 = 1.04 \times 10^{-31}$ (cc./molec.)^{2}sec.$^{-1}$ The analogous reaction with nitric oxide, $CH_3 + NO \rightarrow CH_3NO$ (2), is found to be second order in the same pressure region, i.e., 150-280 mm. of neopentane. At 25°, $k_2 = 1.05 \times 10^{-12}$ cc./molec.sec. It is suggested that the difference in the order observed in the reactions (1) and (2) and the analogous reaction, $CH_3 + CO \rightarrow COCH_3$, for similar pressures and a given M, is related to the difference in the exothermicities of these reactions.

Microfilm $2.00; Xerox $5.20. 104 pages.

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KINETICS OF INITIATION OF POLYMERIZATION

(L. C. Card No. Mic 58-7894)

James Paul Van Hook, Ph.D.
Princeton University, 1958

Although the thermal rate of decomposition of 2,2'-azo-bis-isobutyronitrile (Azo I) had previously been quite extensively studied at temperatures above 60°C. it was felt that further work at lower temperatures by using the ultraviolet absorption technique would yield a much more satisfactory expression for the first order decomposition rate law. Using our values and all the available data in the literature a composite Arrhenius plot is constructed and the expression $k_d = 1.58 \times 10^{15}$ exp (-30.8 kcals/RT) is obtained. This expression is necessary for an accurate evaluation of the initiator efficiency when Azo I is used as a source of free radicals for the study of polymerization kinetics. The bulk polymerization of styrene and methyl methacrylate using Azo I as the initiator has been realized at temperatures from 30°C. to 85°C. The value of the efficiency of Azo I in the polymerization of styrene is calculated to be 60 per cent. The corresponding figure for methyl methacrylate is 80 per cent, which reduces to 60 per cent if the fraction of polymethyl methacrylate chains terminated by disproportionation is equal to 0.3. The efficiency in the case of styrene polymerization is shown to be constant with initiator concentration except at very low Azo I concentration (rate of initiation less than 5×10^{-9} m/l/sec.) where the efficiency increased markedly. This effect has been attributed to a decrease in the magnitude of the secondary combination wastage reaction. This decided increase in efficiency is not realized in the case of methyl methacrylate polymerization.

The solution polymerization of these monomers in benzene and CCl_4 using Azo I as initiator has also been investigated. A'' ($A'' = k_d f [I] [M]^2 / R_p^2$) is shown to increase substantially upon dilution of styrene with benzene or CCl_4. CCl_4 has a much greater effect than benzene in increasing the value of A''. Brief data on the polymerization of methyl methacrylate in benzene and CCl_4 indicate that A'' is constant on dilution of the monomer with either solvent.

Initiation of styrene and methyl methacrylate polymerization using dicumyl peroxide (DCP) has also been accomplished. The activation energy for decomposition of the peroxide is calculated to be 36.4 kcals., determined from polymerization experiments on both monomers from 60°C. to 100°C. Evidence is given to suggest that the initiator efficiency of DCP is unity and that the fraction of methyl methacrylate chains terminated by disproportionation is equal to about 0.3.

Microfilm $2.00; Xerox $5.00. 99 pages.

A KINETIC STUDY OF SOME SUBSTITUTED THIOUREAS

(L. C. Card No. Mic 59-190)

David George Walker, Ph.D.
The University of Texas, 1957

Supervisor: W. H. R. Shaw

Experimental data is presented on: 1-methyl-2-thiourea, 1,3-dimethyl-2-thiourea, 1,1-dimethyl-2-thiourea, 1,1,3-trimethyl-2-thiourea, 1,1,3,3-tetramethyl-2-thiourea and 1-phenyl-2-thiourea. All of these compounds are shown to undergo unimolecular first-order decompositions in aqueous solution with the single exception of 1,1,3,3-tetra-2-thiourea which was the only compound studied having no labile hydrogen atom in the molecule. The stoichiometry of these reactions is demonstrated by analysis for thiocyanate ion, ammonia, methylamine and dimethylamine. The products are shown to be always an amine (or ammonia) and isothiocyanic acid or methyl isothiocyanate. The specific products, of course, depend upon the substituted thiourea reacted.

Arrhenius parameters were determined for all unimolecular decompositions by measuring the reaction rates at five different temperatures spaced ten degrees apart. All of these reactions were found to obey the simple Arrhenius law very closely.

$$k = A \exp(-E_a/RT)$$

The experimental frequency factors obtained were quite similar to those obtained for a great many other unimolecular decompositions, varying from 0.4 to 5.8×10^{14} sec^{-1}.

It was found possible to correlate the reaction rates at a given temperature with the combined effects of:

1. The basic strength of the product amine.
2. The amount of electronic character donated to the product isothiocyanate group by resonance of the substituent on that isothiocyanate group.
3. The tendency of one nitrogen atom to transfer a hydrogen atom to the opposite nitrogen atom.

The possibility of similar reactions in various other compounds is discussed. The hypothesis is advanced that addition compounds formed by the combining of an alcohol or an amine with CO_2, COS, CS_2, RNCO and RNCS are both synthesized and decomposed by very similar mechanisms as that involved in the transformation of thiourea into ammonium thiocyanate. The relative stability of the addition compounds mentioned above appears to be inversely related to the amount of resonance energy contained in the product fragment which is isosteric with HNCS (i.e., CO_2, COS, CS_2, RNCO or RNCS).

Microfilm $2.00; Xerox $4.20. 77 pages.

KINETICS OF ADSORPTION AT THE SOLUTION-AIR INTERFACE

(L. C. Card No. Mic 59-1151)

Terry Charles Wallace, Ph.D.
Iowa State College, 1958

Supervisor: R. S. Hansen

Time and concentration dependence of the surface tensions of aqueous solutions of pentanoic, heptanoic and octanoic acids and heptanol-1 were determined at 20°C. Heptanoic acid solutions were also investigated at 10°C.

It was found that the empirical relation

$$\frac{u}{1-u} = k\,\pi_\infty^2 \exp\,(bu)t \qquad (1)$$

in which $u = \pi/\pi_\infty$, π_∞ is the equilibrium spreading pressure, π the spreading pressure at time t, and k and b are constants, represented the dependence of spreading pressure (surface tension of solvent minus surface tension of solution) on concentration and time to an excellent degree of approximation. This same equation was found to represent data of Addison for aqueous solution of decanoic acid, and of Dervichian for aqueous solutions of hendecanoic acid.

The constant b in equation 1 was found to be nearly independent of adsorbate, and the constant k was found to vary uniformly with adsorbate chain length over the series including both results from the present work obtained by the vibrating jet technique and results of Addison and Dervichian, obtained by conventional surface tension techniques. This furnishes strong evidence that the vibrating jet technique, coupled with the method of interpretation given below, yields objective results for the variation of surface tension with time.

No mechanisms could be found which provide a kinetic interpretation of equation 1. Therefore alternate rate expressions were investigated which would be susceptible to kinetic interpretation. The following rate expression was found to represent adequately all available experimental data:

$$\frac{d\Gamma}{dt} = \frac{\beta C_B}{\gamma^\ddagger}\,(C_B - a_S) \qquad (2)$$

in which Γ is the adsorbate surface excess at time t, C_B is the adsorbate concentration, a_S is the adsorbate activity in the adsorbed film at time t (referred to a standard state such that the activity coefficient is unity at infinite dilution in bulk solution) and $\gamma^\ddagger$ is the activity coefficient of the activated complex at time t. Equation 2 was used with equation 1 to obtain the ratio $\gamma_S/\gamma^\ddagger$ where γ_S is the activity coefficient of adsorbate in the surface film at time t; it was found that this ratio depended on π only and from this it may be concluded that the transition state occurs in or near the surface film. The constant β is found to be of the same order of magnitude for all systems investigated.

It is concluded that the adsorption of the normal aliphatic acids C_5 - C_{11} and of heptanol-1 can be treated by kinetic theory and adsorption mechanisms inferred similar to the manner used in the study of bulk reaction mechanisms, and that in all of the above cases the adsorption rate determining step is second order in adsorbate. Possible reasons for this order are discussed.

An apparently significant variation of the surface tension of pure water with time as a function of temperature was found. A possible mechanism is suggested, and possible confirmatory experiments suggested.

Microfilm $2.00; Xerox $6.00. 124 pages.

STUDIES IN MOLECULAR SPECTROSCOPY. STRUCTURE AND BONDING OF METAL CARBONYL COMPOUNDS.

(L. C. Card No. Mic 58-1821)

William Enoch Wilson, Jr., Ph.D.
Purdue University, 1958

Major Professor: Walter F. Edgell

The structure and bonding of metal carbonyl hydrides have long been a subject of speculation. One of the latest proposals is a structure for $HCo(CO)_4$ in which the hydrogen atom forms a bridge between three CO units. The primary purpose of this study was to test this model and determine if it could be applied to other molecules.

$DCo(CO)_4$ was prepared with only a small amount of $HCo(CO)_4$ impurity and its spectrum determined from 2 to 35 microns. The band at 703 $cm.^{-1}$ in the hydride shifted to 600 $cm.^{-1}$ in the deuteride. This indicates that this band is largely a hydrogen motion. Smaller shifts of other bands indicate that the hydrogen modes are strongly mixed with the CO bonding and Co-(CO) stretching modes. The spectrum could be interpreted in terms of either a C_{2v} or C_{3v} bridge structure.

$H_2Fe(CO)_4$ and $HDFe(CO)_4$ were prepared and their spectrum determined. By comparison with the spectrum of the related molecule $Fe(CO)_2(NO)_2$ it was possible to interpret the spectrum of $H_2Fe(CO)_4$ in terms of a C_{2v} bridge model in which each hydrogen atom forms a bridge between three CO groups. In this compound the hydrogen modes fall between 700 and 800 $cm.^{-1}$, but are very strongly mixed with skeletal modes.

$H_2Fe(CO)_4$ is a very unstable molecule. At low pressures the vapor has a half life of about five minutes. The major decomposition product, $Fe(CO)_5$, obscures much of the spectrum. In order to obtain satisfactory data it was necessary to develop a special assembly for cooling a liquid cell and examine the hydride and the deuterated species as liquids or in solution.

The infrared spectrum of $Fe(CO)_5$ was determined from 2 to 50 microns and an assignment of fundamental frequencies made. It is pointed out that a metal-carbon bond order of greater than one and a carbon-oxygen bond order of less than three is consistent with present knowledge.

The five micron spectral region of a number of metal carbonyl compounds were determined with high resolution. The bands were assigned to various fundamentals, combinations, and isotopic species and some of the difficulties in interpretation resolved. The necessity of assigning a CO stretching fundamental to a frequence of about 2100 $cm.^{-1}$, in addition to frequencies between 2000 and 2050 $cm.^{-1}$, is emphasized.

Microfilm $2.50; Xerox $8.60. 189 pages.

ECONOMICS, GENERAL

THE DEMAND FOR COAL FOR POWER GENERATION IN THE TENNESSEE VALLEY AND THE IMPACT OF CHANGING DEMAND PATTERNS ON A SUPPLYING COAL FIELD

(L. C. Card No. Mic 58-7909)

Edwin George Charle, Jr., Ph.D.
Indiana University, 1958

In recent years the patterns of coal consumption in the United States have undergone significant changes. While the use of coal by some groups of consumers has declined seriously, the demands of other users--especially the nation's electric generating plants--have been undergoing rapid expansion. It is probable, moreover, that major changes in consumption patterns will continue to characterize American coal markets in the future.

A change in the type of consumer utilizing the output of a coal field may cause serious adjustments in mining activities and employment in that field. This study analyzes the development of the demand for coal for power generation in one area of the United States--the Tennessee River Valley. Consideration is given to the economic characteristics of this demand and to the way in which an important segment of the demand has been satisfied by a group of coal producers who previously had been dependent on the rapidly declining purchases of other customers.

A "normal" expansion of fuel requirements for power production in the Tennessee Valley was seriously curtailed between 1933 and 1950 because of the rapid creation of hydroelectric generating capacity under the federally sponsored Tennessee Valley Authority program. After 1950, however, when the hydro potential of the region had been substantially exhausted, the demand for fuel increased rapidly, and the TVA quickly became the nation's largest consumer of bituminous coal. The Authority has entered the coal markets frequently and has purchased on the basis of relatively short term contracts with many producers. Since 1955 the TVA has been required to restrict its major purchases to producers paying the "prevailing minimum wage," as this was determined by the Secretary of Labor under the provisions of the Walsh-Healey Public Contracts Act.

Since 1953 coal producers in North Central Tennessee and in adjacent areas of Kentucky have been shipping large quantities of coal to the TVA's Kingston Steam Plant, the largest steam generating station in the world. Formerly those producers had sold most of their output to the railroads and for domestic heating, but by 1954, the demands of these customers had declined to a small fraction of their former magnitude. There was widespread unemployment among miners in the area.

The terrain in this supply region is irregular and the coal seams thin and frequently discontinuous. For many years most of the coal produced had been hand loaded in underground mines. There was some machine loading in the thickest portions of the coal seams, and by 1950, some contour strip mines had begun operation.

The strip mines and mechanical loading deep mines--which produced relatively large amounts of coal per man employed--became Kingston's most important suppliers. New strip mines began production and the existing operations expanded their output. Despite the magnitude of Kingston's purchases, the hand loading underground mines offered little coal to the Steam Plant in the highly competitive market which developed. These mines produced a product with special characteristics at high cost which could not be marketed profitably to the TVA which placed no premium on the size and structure of coal which it purchased. The average mine price of coal produced declined substantially.

The prices at which coal was offered to Kingston varied relatively less at each bid invitation than would have been suggested by obvious differences in operator production and transportation costs. Mines offering coal of varying qualities tended to adjust their bid prices so that TVA's cost per unit of delivered heat content varied far less than relative quality differentials. From 1954 through 1957 the trend in bid prices reflected quite closely the magnitude of the total demand imposed on the field.

Many mines in the area underwent recurrent periods of idleness as existing facilities proved capable of supplying substantially more coal than the total being purchased. The TVA's policy of purchasing individually small quantities of coal on the basis of relatively short term contracts intensified the competitive uncertainties associated with the excess capacity.

Because the coal burned at the Steam Plant originated at those mines which utilized their labor most efficiently, the increased output resulting from expanding sales to Kindston was accompanied by a decline in mine employment, as non-TVA demand continued to weaken. Moreover, the new mines and those expanding operations frequently drew workers from the non-mine labor force thus intensifying the problems of miner unemployment.

Microfilm $3.10; Xerox $10.60. 237 pages.

THEORY AND PRACTICE OF BENEFIT-COST ANALYSIS

(L. C. Card No. Mic 59-653)

Robin C. Linstromberg, Ph.D.
University of Oregon, 1959

Adviser: H. T. Koplin

The public agencies charged with the responsibility for development of the nation's water resources evaluate water-use projects on the basis of a benefit-cost analysis, selecting for development those projects which promise an excess of estimated benefits over expected costs. This

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thesis examines the methods adopted by the United States Army Corps of Engineers, the Bureau of Reclamation of the Department of the Interior, the Department of Agriculture, and the Federal Power Commission in making the analysis and explores the economic implications of the analysis.

The problem is discussed in three parts. The first is expository, presenting the agency practices in conducting the analysis. The second part is a discussion and evaluation of these practices and of the literature of the field. The third part summarizes the findings of the second part and evaluates them in a broader context.

The major conclusions are as follows: (1) Undue discrepancy exists between the agencies in measuring benefits and costs, especially in measurement of indirect benefits and costs. The methods adopted by the Corps of Engineers, the Department of Agriculture, and the Federal Power Commission appear to understate the benefits and costs from water resources development since indirect effects are largely excluded from consideration. The measurement practices of the Bureau of Reclamation lead to overstatement, since both the benefits and costs which stem from the project and those which are induced by the project are included as indirect benefits and costs, a procedure which constitutes double counting.

(2) Because of institutional and technological conditions surrounding water resources development, the ranking of projects for development in the order of their benefit-cost ratios will lead to inefficient allocation of investment funds. Limitations upon capital funds make it impossible to develop all of the economically justifiable projects to the point at which the marginal returns from investment will equal the marginal cost of that investment. The existence of technological indivisibilities and complementarities between projects and project purposes make it impossible to satisfy the marginal conditions within the capital limitation. This will necessitate choice of second best solutions rather than an optimum solution in the Paretian sense.

(3) The apparent agency practice of calculating both amortization and replacement costs as annual charges results in double counting. It is probable that this causes projects which are relatively less capital intensive to be favored over those which require rather more capital.

(4) The selection by the Corps of Engineers and the Federal Power Commission of a fifty-year maximum for the period of analysis provides a hedge against uncertainties that could be provided more realistically through the interest and discount rates and/or risk allowances.

Microfilm $3.25; Xerox $11.20. 252 pages.

ECONOMIC PLANNING WITHIN SMALL AGRICULTURAL WATERSHEDS

(L. C. Card No. Mic 59-1141)

George Anthony Pavelis, Ph.D.
Iowa State College, 1958

Supervisor: John F. Timmons

The problems dealt with in this study are posed by new emphasis on small watersheds as cultural and decision-making units for the conservation and development of soil and water resources. They include: (1) application of multiple-purpose concepts heretofore used in river basin planning to the evaluation of conservation needs and development opportunities in much smaller drainages; (2) reconciliation of the plans of farmers controlling watershed uplands with those of other private or public units affected by their use; and (3) formulation of optimal development programs for small watersheds.

Objectives are to treat these problems by outlining a framework for evaluating development possibilities and devising a series of development programs for the 480-acre Nepper Watershed, located in Monona County of western Iowa. The importance of watershed hydrology to benefit-cost appraisals of alternative development activities and the physical nature of recommended programs is stressed.

Given average farm prices projected for a stated planning period (1947-97), resources available for development purposes, and input-output relationships of various development activities, optimal programs are devised with reference to variable amounts of total expenditure involved, utilizing "linear programming." The method is used to (1) illustrate how all resources can best be allocated among competing activities as one might be varied in quantity; and (2) indicate the relation of linear programming to conventional principles of project formulation based on benefit-cost comparisons.

The "planning norm" to be achieved by optimal development of the Nepper Watershed is presumed to be a maximum discounted value, at the 1947 planning date, of net returns from primary agricultural production (excluding livestock). In addition to normal production expenses on farms, all land-use-associated gully damage, flood damage, and damage-control outlays are charged as costs of this output. Optimal programs are then given as combinations of land treatment and structural activities producing maximum discounted net benefits, or maximum increased discounted net returns for the watershed community of seven farms, Monona County, and immediate downstream interests. The year 1947 is taken as the benchmark or planning date to illustrate optimal planning without reference to the Little Sioux Flood Control Program actually undertaken in 1948; to appraise this program with regard to possible alternatives as devised in the study; and to utilize the basic data available to or contributed by the Little Sioux planning group.

Because of the fixed character of uneconomic structural improvements installed in the 1948 Little Sioux Program, many of the results of linear programming are hypothetical. Consequently, the study concludes with presenting the yield-increase benefits of watershed farmers shifting from the current (1957) pattern of land use to that representing an optimal development program, despite the effectiveness of land use changes in damage control being largely pre-empted by uneconomic structures.

Microfilm $3.30; Xerox $11.20. 254 pages.

NONAGRICULTURAL EMPLOYMENT IN THE USSR, 1928 - 55

(L. C. Card No. Mic 59-740)

A. David Redding, Ph.D.
Columbia University, 1958

This thesis is concerned with establishing the volume of nonagricultural employment in the USSR (Chapter 2), its distribution by broad economic sectors such as industry and transportation (Chapter 3), estimates of the total number and sector distribution of the workers excluded from Soviet statistics--principally self-employed and cooperative workers, forced laborers and Communist Party employees--(Chapter 4), and the distribution of industrial employment among branches such as metalworking and textiles (Chapter 5). Selected USSR-United States comparisons are drawn and discussed in each chapter as appropriate, together with whatever economic inferences seem warranted. The current labor market in the USSR and the prospects for future growth of nonagricultural employment are discussed, conjecturally, in the concluding chapter.

Nonagricultural employment in the USSR averaged only about 10 million persons in 1928--or about 12 to 13 million if account is taken of certain groups excluded from the official statistics. By contrast, the United States employed more than that number nonagriculturally in 1890, at a time when this country's population was only 40 per cent as large as the 1928 Sovient population.

During the period under review, Soviet nonagricultural employment increased at a rate much greater than that in the United States during any recorded period of comparable length, and also much more rapidly than the Soviet population. By 1955 nonagricultural employment in the USSR had exceeded the prewar United States level, and was nearly as great as in the early postwar years in this country. Still, after more than a quarter century of rapid industrialization, the proportion of the Soviet population nonagriculturally employed in 1955 was less than three quarters as large as in the United States--a concomitant of the very large proportion of the Soviet labor force in agriculture.

The findings indicate the relatively early stage of industrialization, employmentwise, in the USSR throughout the period. They also indicate that the employment trends --that is, the shift from the agricultural to the nonagricultural sector--are along lines generally similar to those in the United States during earlier years.

Regarding the distribution of nonagricultural employment, a significantly larger proportion in the USSR has been engaged in industry, construction, and transportation --again compared to the United States--while a considerably smaller proportion has been employed in services-government-commerce. (In terms of total employment, however, only agriculture has been a more important employer in the Soviet Union than in the United States; even industry and construction have occupied a significantly smaller proportion of the total in the USSR.) In neither country is there evidence of an employment shift within the nonagricultural sector from industry and construction to services-government-commerce. The absence of a long-term trend in the share of industrial in total nonagricultural employment in both countries, and the persistence of the differences between the employment structures of the two countries suggest that the structure of nonagricultural employment is largely independent of the stage of industrial development.

The industry sector showed the largest employment increase in absolute terms since 1928. The pool of skilled and semiskilled manpower in small-scale industry contributed significantly to this increase--and to the resultant growth of output--especially in the early years of industrialization. The structure of industrial employment in the USSR and United States appears to have been more similar than that of either total or nonagricultural employment in the two countries during the period studied.

Microfilm $4.30; Xerox $14.60. 336 pages.

THE ACCELERATION PRINCIPLE: DEPARTMENT STORE INVENTORIES, 1920 - 1956

(L. C. Card No. Mic 59-741)

Newton Young Robinson, Ph.D.
Columbia University, 1958

The primary purpose of this dissertation was a partial testing of an adaptation of J. R. Hicks' theory of the business cycle.[1] According to Hicks' theory, business cycles are caused by interaction of the accelerator and the multiplier. Hicks uses his theory to explain cycles which are caused by fluctuations in capital investment. This study, however, tests an adaptation of Hicks' theory to the explanation of the minor business cycles in the United States which are commonly thought to be caused by fluctuations in inventory investment.

Since inventory investment is widely believed to be induced by changes in the level of economic activity, this appears to be a reasonable adaptation of Hicks' theory. It is not realistic, however, unless the amount of induced investment in inventories is sufficiently great. The primary purpose of this dissertation, consequently, was to measure the amount of induced investment in inventories. Due to the lack of adequate data, it was impossible to do so on an aggregative basis. Therefore this investigation was restricted to a disaggregative study of a single type of inventories. This means that other studies must be made before it will be possible to express an informed opinion as to the sufficiency or insufficiency of induced investment.

Department store inventories were selected for this first study because of the substantial body of seasonally adjusted monthly data made available by the Board of Governors of the Federal Reserve System. The availability of such a large body of excellent data also made it possible to investigate the effect of other variables thought to influence inventory investment by department stores.

The method used was to fit equations similar in form to Hicks' equations, by the method of multiple regression, using an International Business Machines Corporation type 650 data-processing machine (electronic computer). Data on stocks and sales were reduced to seasonally adjusted deflated changes expressed as a percent of the moving average of the previous twelve months, to guard against a variety of possible biases. The regression coefficients obtained in these multiple correlations are measures of the amount of induced investment.

Results of this study indicate that the amount of induced investment in department store inventories is quite substantial. The estimates for the period March, 1920 through July, 1941 (the period for which the results of this study are believed to be most accurate) indicates that the ratio

of induced investment in department store inventories to changes in the income created by department stores (i.e., changes in value added by department stores) is approximately 4.4. This particular ratio is used since Hicks relates induced investment to changes in income. In Hicks' terminology this measure would be called the total investment coefficient. Such a large total investment coefficient lends considerable support to the adapted theory.

As mentioned above, Hicks relates induced investment to changes in income. Many economists, when writing about the acceleration principle, use the ratio of induced investment to changes in sales. For the same period, the best estimate of this ratio was 1.7.

Results obtained for other variables are interesting primarily because they indicate that these variables are not important factors affecting inventory investment by department stores. Results of this study indicate that high interest rates have no measurable effect towards reducing inventory investment by department stores and that low interest rates have no measurable effect towards increasing inventory investment. Recent changes in wholesale prices appear to have little or no effect upon inventory investment by department stores. Recent changes in inventories tend to deter changes in the same direction, but the effect is slight. This inability to find any variables, other than changes in sales, which have an important influence on inventory investment by department stores supports the belief that this type of investment is primarily induced investment.

Microfilm $2.00; Xerox $7.00. 149 pages.

1. J. R. Hicks, A Contribution to the Theory of the Trade Cycle (Oxford: At the Clarendon Press, 1950).

SOME EFFECTS OF FILM PACKAGES AND UNIFORM SIZING ON RETAIL POTATO SALES

(L. C. Card No. Mic 59-141)

Harlon Dwain Traylor, Ph.D.
Cornell University, 1958

The purpose of this study was to suggest means for improving merchandising programs for potatoes. Some effects of two merchandising innovations were analyzed, namely (1) use of polyethylene bags for potatoes and (2) use of potatoes separated into uniform sizes. Five experiments were conducted during the autumns and winters of 1955, 1956 and 1957, as part of a Northeastern regional potato marketing research project. From 8 to 16 supermarkets in upstate New York cooperated in making these studies possible. Designs such as latin squares, and test versus control stores were used to analyze some of the effects of selected merchandising practices.

Total pounds of potatoes sold increased considerably over a short period of time in these supermarkets when relatively large experimental polyethylene bags were introduced into conventional potato displays at the same price as their paper counterparts. In one experiment this amounted to 15 per cent. Conventional potato displays consisted mostly of various sizes of paper packages. The increase was only slightly less when price premiums were charged for the experimental bags to cover possible extra costs of packing in this manner. When the experimental bags were sold over a longer period of time, however, the large increase appeared to be temporary. In one experiment the initial large increase lasted for two weeks and after that was small. This phenomenon appears to be explained in part by the fact that many of the purchases of the large polyethylene package were made by customers who ordinarily purchased smaller size paper packages. These customers probably were not in the market for potatoes again as soon as they otherwise would have been. Total potato sales from displays containing medium and relatively small size experimental polyethylene bags of potatoes were little different than sales from conventional displays. Sales of all sizes of the experimental packages accounted for a considerable proportion of the total potatoes sold in terms of weight, number of purchases and dollar sales. When price premiums were required in one experiment, the relatively large experimental polyethylene bags of potatoes as a per cent of total potato sales declined only slightly. Over a period of time, however, the experimental bags as a proportion of the total potatoes sold declined sharply but was still about 13 per cent of the total with 5 other types of bags competing.

Total potato sales in the short run did not seem to be greatly affected by use of uniform sizes (1-7/8" to 2-1/2", 2-1/2" to 3-1/4" or 3-1/4" to 4") either sold one size at a time or simultaneously. When displayed simultaneously in a relatively large experimental polyethylene bag, however, about one-fourth of the total potato sales were in the experimental packages containing the uniform sizes. Of this one-fourth the size 2-1/2" to 3-1/4" accounted for nearly 75 per cent. When price premiums were charged for the uniform sizes they accounted for only about one-fifth of the total and of this the size 2-1/2" to 3-1/4" accounted for about 67 per cent. The volume of the 2-1/2" to 3-1/4" size which was lost when price premiums were charged was absorbed by non-uniform size potatoes. These non-uniform size potatoes were in regular paper packages and in another experimental polyethylene bag of the same type as that used for the uniform potatoes but for which no premium was charged.

Microfilm $2.05; Xerox $7.20. 154 pages.

ECONOMICS, COMMERCE – BUSINESS

AN ANALYSIS OF THE PHILOSOPHIES PROMPTING GOVERNMENTAL INSURANCE PROGRAMS, WITH SPECIAL REFERENCE TO ATOMIC RISK COVERAGE

(L. C. Card No. Mic 59-359)

William Randolph Beaton, Ph.D.
The Ohio State University, 1958

The basic purpose of this study was to discover the reasons which prompted the enactment of certain governmental programs of insurance. The focal point of the study was an analysis of the nuclear energy peril and the insurance problems created by this peril. The purpose of the analysis was to determine the reasons which prompted the federal government to enact legislation

providing governmental indemnity for certain activities in the nuclear energy field. The purpose of the analyses of earlier governmental programs of insurance was to provide a background for determining the pattern of thought and factors which influenced subsequent programs, particularly nuclear energy loss indemnification.

The chief sources of information used in the study were the hearings, studies, and reports of Congressional committees to which original legislative proposals were referred for action. The Congressional Record was especially useful in studying the attitudes of legislators toward proposed federal programs. The published views and analses of advocates and opponents of proposed programs, such as individual social reformers, economists, and trade associations, provided information concerning the reasons why particular legislation was enacted. These views appeared in the form of books, pamphlets, brochures, speeches, and conference reports.

The approach used in this study was to give, first, a brief introductory description of the program under consideration. The programs were classified according to the perils which they cover, such as the perils resulting from business operations, the perils resulting from natural and man-made disasters, the perils of personal insecurity, and the perils arising from the use of nuclear energy. Attention was next given to the factors which influenced the development of these programs. This necessitated a study of the social, economic, and political environment existing at the time of enactment, as well as an analysis of the retarding influences or the negative forces arising in connection with the proposals.

After an analysis of the influences behind each particular program, a summary was made in which the various factors were tied together to present the philosophy prompting the establishment of each program.

This analysis of the earlier governmental programs was followed by a rather detailed and comprehensive investigation of the nuclear energy peril. The unusual nature of the peril was considered first, and then an analysis was made of the technical problems in this field which have created difficulties from an insurance viewpoint. Attention was then focused on the development of the philosophy which prompted the federal government to participate in the writing of insurance for this peril.

The following conclusions were reached in this study: (1) Government has typically entered the field of insurance when the national interest or the general welfare of the country is involved. (2) Government entrance has usually been conditioned on the nonavailability of the desired insurance from private insurers. (3) Government has entered the field of insurance as the result of a natural evolution of a governmental function, i.e., title insurance. (4) Political expediency often prompted the final enactment of a governmental program of insurance. (5) Government has often been forced into programs of insurance as the result of social pressures resulting from a change in social philosophy.

Microfilm $4.15; Xerox $14.00. 323 pages.

A SURVEY OF MANAGEMENT CODES OF ETHICS IN THE METAL PRODUCTS INDUSTRY

(L. C. Card No. Mic 59-362)

Jay Richard Box, Ph.D.
The Ohio State University, 1958

The ultimate objective of the study was to provide information which would facilitate the development of greater confidence in our system of free enterprise. Accordingly, it was sought to assemble factual information, through primary research, concerning the nature, use, force, value, and effectiveness of ethical codes or other statements of policy adopted to guide executives in business relations at both industry and company levels.

Some 356 trade associations in the metal products industry were surveyed. The three associations selected for further study at the company level were The Gray Iron Founders Society, Inc., having a formalized code of ethics; The Radio-Electronics-Television Manufacturers Association, operating under FTC Trade Practice Rules; and the Aircraft Industries Association, having neither. Questionnaires were used to obtain subjective opinions concerning the use, factors influencing adoption, provisions for enforcement, methods of publication, and opinions concerning the value and effectiveness of formalized codes. Reasons for not adopting a code and information concerning operation under a recognized informal code were also sought. Copies of formalized codes were also requested for further study.

Of the 356 trade associations surveyed, replies were received from 145 (40.7%). Of this number 28 (19.31%) had developed their own codes, and 16 (11.03%) operated under FTC Trade Practice Rules. Of the 959 companies surveyed, replies were received from 211 (22%), with 175 returning questionnaire data. Twenty-one companies (12%) had adopted formalized codes, while 50 per cent operated under recognized informal codes. The desire to insure uniformity of practices was the most frequently offered reason for the adoption of a code. Lack of need and the misuse of codes were frequently mentioned reasons for non-adoption. Fewer than a third of the companies actually used their association and company codes in the formulation of company policy. Few companies had provided either for enforcement or for corrective action when codes were violated. While the association codes placed the most emphasis upon customer, competitor, and dealer relations, the company codes (usually less detailed) gave considerable attention to employee and internal managerial relations. FTC Trade Practice Rules tended to be much narrower in scope (but more detailed) and less useful in the formulation of company policy than were the ethical codes adopted by trade associations.

Efforts to interest trade associations and their members in the formalization of ethical beliefs should be continued and augmented. Model codes can be helpful if they are carefully adapted to the particular needs of the firm. A definite procedure should be established to facilitate the development and promulgation of codes. Once adopted, codes should be reviewed periodically and kept up to date. The survey showed that this is generally neglected. There is a tendecy for member firms to rely upon their association code rather than develop their own. Thus trade associations need to promote actively the formalization of ethical beliefs among their memberships. The use of

informal codes should be encouraged with intent of eventual formalization.

There is still considerable doubt at the company level regarding the value and effectiveness of formalized codes. Only 43 per cent of the firms offering their opinions on this point were in favor of them. However, the firms adopting codes and putting their tenets into actual practice benefited greatly. It is the belief of the writer that continued efforts to promote the formalization of ethical concepts will implement the development of business ethics as an integral part of our American free enterprise system.

Microfilm $4.90; Xerox $16.40. 381 pages.

COPPER FABRICATION: OUTLOOK FOR EXPANSION IN THE WESTERN UNITED STATES

(L. C. Card No. Mic 59-256)

Norman W. Clark, Ph.D.
Stanford University, 1958

Purpose of the Study

The great bulk of United States domestic copper ores is mined, milled, and smelted within the borders of the economic region comprised of the eleven Western states: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

However, most of the raw copper produced in this Western region is sent elsewhere for fabrication. The purpose of this dissertation is to assess the outlook for expansion of copper fabricating industries within the eleven Western states and the consequent possibilities of an enlarged contribution on the part of domestic copper resources to the industrial development, employment, living standards, and general social progress of the West.

Methodology

Research methods of the author included field visits to primary copper producing facilities and to copper fabricating plants as well as interviews and correspondence with representatives of copper industry trade associations, primary copper producers, copper fabricators, copper distributors, transportation agencies, financial institutions, and users of fabricated copper goods. The author also examined available literature, including numerous books, magazines, pamphlets, government documents, newspapers, and annual reports and house organs of copper industry firms.

To provide a point of departure for the analysis, broad outlines of the present locational structure of the nation's copper industries are developed, and copper's position relative to competing materials is examined.

Separate chapters are devoted to analysis of the locational determinants of primary copper production facilities, brass mills, wire mills, and foundries and miscellaneous copper fabricators.

The economy of the eleven-Western-state region -- population, income, and industrial development -- is analyzed and compared with the nation as a whole. The author suggests courses of action which the Western states might themselves take to stimulate copper fabrication within their borders and points out specific area which he believes to be the most probable sites for new or expanded copper fabricating plants.

Conclusions

The author believes that the outlook for both copper markets and supplies is favorable and the expansion of the nation's copper fabricating facilities will be necessary in the years ahead. He also concludes that the nature of the locational determinants of copper fabricating plants is conducive to a gradual increase in the amount of Western copper fabrication.

The derived nature of the demand for the products of copper fabricating plants makes the construction or expansion of copper fabricating facilities contingent upon prior development of other industries. However, the eleven-Western-state region analyzed in this study is growing at a rapid rate and has reached a point at which it represents a substantial part of the national demand for goods made of copper or goods in which copper is used as a component.

A number of areas within the eleven Western states are believed by the author to hold promise for development of new or expanded copper fabricating facilities in the immediate future. Those believed to have the greatest development potentialities include the industrialized population centers of the Los Angeles, San Francisco, Portland, and Seattle areas in the three Pacific states; the Denver-Pueblo metropolitan areas in Colorado; and the Salt Lake City, Utah, area with its primary copper-producing facilities and its stratetic location for efficient distribution over a wide area.

It is the additional conclusion of the author that as the national economy enters into another period of substantial growth, copper fabricating firms and state and local development agencies might very profitably investigate the possibilities for establishment and expansion of copper fabrication in these specified areas.

Microfilm $4.60; Xerox $15.40. 357 pages.

EXCLUSIVE DISTRIBUTORSHIPS AND DEALERSHIPS

(L. C. Card No. Mic 59-368)

Robert Edward Dillon, Ph.D.
The Ohio State University, 1958

Throughout the 1950's, keen competition has induced many executives to re-evaluate and sometimes change their marketing practices. They have been hindered, however, by a scarcity of accurate information about policies dealing with the breadth of distribution, especially "exclusive agency" distribution.

"Exclusive agencies" provide essential services in distributing a large number of manufactured goods. Sales amount to billions of dollars annually. Yet, information about this method of distribution has been quantitatively and qualitatively inadequate. Consequently, this study was made in order to amplify and clarify the existing data. It is entitled "Exclusive Distributorships and Dealerships" in order to avoid ambiguity. It does not deal with agencies. It is a study of merchandise distribution through wholesale

and retail merchant middlemen who hold exclusive territorial selling rights to certain of their vendors' products. It adds to the existing literature a detailed explanation of producer-outlet relationships; a current listing of products sold as exclusives; analyses of legal, economic, and policy implications; and a glossary.

The research methodology involved an accumulation of all secondary materials and a field survey. Secondary sources were books, periodicals, theses, dissertations, governmental publications, and trade association reports. Primary data were obtained from responses to questionnaires mailed to 307 manufacturers, 315 wholesale middlemen, and 60 retailers.

Exclusive distributors (wholesale middlemen) handle a wide variety of durable and nondurable industrial and consumer products. They sell all types of industrial goods. They also carry all classification of consumer products, but they specialize in shopping items and rarely handle convenience goods. Exclusive dealers sell specialty items and some shopping goods, but never handle convenience goods. Exclusive distributors sell more products in greater dollar volume than do exclusive dealers.

It is the policy of exclusive distributors to market all types of products, but exclusive dealers normally distribute specialty items only.

The numerous advantages to manufacturers of exclusive distribution can be summarized as profit maximization and outlet control. The major disadvantage, occurring only when this method is improperly utilized, is insufficient sales volume. The most important benefits accruing to middlemen are profits and prestige. The most significant disadvantages are loss of freedom of action and low sales when the method is used incorrectly.

Manufacturers usually dominate their relationships with outlets, but have little control in certain product lines. The relationships, sometimes formalized in writing and sometimes arrived at orally, occasionally result in friction, but none, as yet, has been lastingly serious.

There are many legal issues involved in exclusive outlet distribution and all have been the subject of litigation. Almost all are of a federal antitrust nature. They include such important matters as right of refusal to sell, exclusive dealing, vendor selection of vendees' customers, exclusive territories, territory protection, duration of contracts, tying contracts, and full line forcing.

From an over-all economic viewpoint, exclusive selling causes some reduction of competition, which is not necessarily undesirable. While the general effects of exclusive selling on prices and costs are difficult to determine, it appears that prices are not affected adversely and that costs tend to be lowered.

Exclusive distributorships and dealerships are important, integral parts of the marketing structure. Their proper use should result in distributive and productive efficiencies beneficial to producers, middlemen, and the public. Microfilm $3.05; Xerox $10.40. 233 pages.

A STUDY OF FUNCTIONAL GROWTH IN SAVINGS AND LOAN ORGANIZATIONS

(L. C. Card No. Mic 59-157)

Dennis B. Ford, Jr., Ph.D.
The University of Texas, 1958

Supervisor: Dr. William R. Spriegel

The proper structuring of the functional organization of business enterprises as a factor in promoting economic efficiency has been recognized and has received considerable attention during the past several years. The purpose of this study is to explore the nature of functional growth in relation to the size of the business enterprise in the savings and loan industry and the relationship between business functions during their growth.

First, a theoretical framework was developed in order to establish criteria and terminology for use in analysis. This framework included the theory of organizational growth involving devolution and evolution of function. Next, an intensive interview survey was made through the visitation of seven associations and the interviewing of the first and second level executives of these associations. Based on the information acquired during the intensive study, a questionnaire then was developed which was mailed to the members of the Texas Savings and Loan League. These questionnaires were analyzed and a supplemental questionnaire designed to fill in specific information concerning functional growth patterns and cross-functional relationships.

This study revealed that (1) the patterns of functional growth in the savings and loan industry are quite varied but there are tendencies of functional development which are common to most organizations in the industry; (2) all organic functions do not develop to the same degree nor at the same rate; (3) the confused cross-functional relationships increase at a rapid rate as the organization increases in size.

Finally, based upon the findings of the study, recommendations were made for effective organization development in the savings and loan industry.

Microfilm $2.90; Xerox $10.00. 222 pages.

PUBLIC POLICY IN MARKETING: SALES BELOW COST PROHIBITIONS IN THE CALIFORNIA GROCERY TRADE

(L. C. Card No. Mic 59-268)

Donald Gene Halper, Ph.D.
Stanford University, 1958

Comparatively little attention has been given by business students in recent years to state sales below cost prohibitions. Developments with respect to "Fair Trade" in various jurisdictions continue to whittle at the foundations of this pricing control. If only for this reason, it appears necessary to broaden understanding of the related (and often-considered alternative to "Fair Trade") controls referred to as "unfair practices acts" or "anti-'loss leader' laws."

The present study confines itself primarily to examination of experience in California with the Unfair Practices Act. Specific objectives include:

1) Identification of recent developments involving the loss limitation provisions of the Act, particularly in the grocery trade.

2) Anticipation of future developments in this same area.

3) Determination of public policy requirements in this framework.

Four parties or groups account for most activity relating to the Act: the Attorney General, the district attorneys, the grocery trade organizations, and miscellaneous individuals and groups. Loss limitation activities of these groups include legislation, litigation, enforcement, and publicity.

Judicial and legislative events have combined to give the Attorney General potentially effective means of prohibiting sales below cost under the Act. During the recent period, however, the Attorney General has played a passive role in enforcement, in an effort to base his policy in the "hard" competition tradition of the Sherman Act.

For the most part, recent grocery trade group loss limitation activities have centered in legislation, informal-enforcement, and publicity attempts, rather than in litigation against deep price-cutters. These activities have resulted in some success in attaining the grocery trade group goal of loss limitation. In most cases this success has been short-run or confined to limited areas. The accomplishments in toto have not reflected the broad price stabilization envisioned for the grocery trade by the Act's supporters.

District attorneys in California typically have played only a slight role in loss limitation activities. Grocery trade groups have found district attorney criminal suits against price-cutters to be ineffective. As a result, these groups seek to obtain through legislation the right of injunction for the district attorney, in order to strengthen his position in applying the Act.

A recent movement affecting the grocery trade and loss limitation is found in efforts to establish a trade commission to enforce the Unfair Practices Act. Although the idea itself is not of recent origin, the present movement is significant because of support from trades not traditionally interested in enforcement of the Act.

The future of sales below cost prohibition in the California grocery trade appears to lie in two directions. Continuing efforts by the trade groups to broaden the role of public officials in enforcement of the Act and in trade regulation generally appear likely. In addition, the grocery trade groups will emphasize activities other than litigation in seeking to effect widespread sales below cost prohibition. In view of limiting factors, neither development offers the trade any broad accomplishment in the near future with respect to its goal.

From a public policy viewpoint the present study reveals a widened role for neither the Attorney General and district attorneys nor private trade associations to be desirable in sales below cost prohibition. If a real problem of unfair sales below cost does exist, it should be considered in the broader context of trade practices generally. An administrative agency approach for the furtherance of healthy competition and the prevention of unfair practices should be considered in this area. Legislation should be introduced, however, only after careful study of the problem by a committee appointed for that purpose by the Governor or Legislature.

Microfilm $3.40; Xerox $11.60. 261 pages.

THE DEVELOPMENT OF STANDARDS OF WORK PERFORMANCE IN STAFF ACTIVITIES: A CASE STUDY OF WORK MEASUREMENT IN PROCUREMENT AND PRODUCTION ACTIVITIES IN THE UNITED STATES AIR FORCE, SAN ANTONIO AIR MATERIEL AREA, AIR MATERIEL COMMAND

(L. C. Card No. Mic 59-173)

Kenneth William Olm, Ph.D.
The University of Texas, 1958

Supervisor: Professor William R. Spriegel

This study is concerned with the development of a work measurement system which will provide for the establishment and proper use of valid standards of work performance for office work of a clerical and administrative nature. The work which was studied is typical of a large number of occupations in modern business enterprise and in government service.

Certain characteristics of the work placed under study made it necessary to develop a specialized work measurement system. Among these limiting characteristics were the following: (1) the relatively long work cycle, (2) the wide latitude allowed in the selection of the work method, (3) the general lack of a written standard practice for each job, (4) the considerable amount of fluctuation in work input, and (5) the varying degree of judgment required in the performance of the work under study. In addition, it was necessary to adhere to good human relations practices to insure maximum acceptance and cooperation by employees at all levels in the organization.

The work measurement system reported on in this study was developed as a "service test" in the Directorate of Procurement and Production of the San Antonio Air Materiel Area. The results of the service test were expected to indicate the feasibility of applying work measurement to staff activities common to the procurement function throughout the Air Materiel Command.

Work sampling was chosen as the preferred method in place of the more traditional methods of direct stop-watch time study, of predetermined motion time values, or of the simple calculation of average times from historical data.

The first step in the process of developing the work measurement system was to present to all employees an explanation of why work measurement was needed and how it was to be achieved.

Following this indoctrination, all of the positions were analyzed in detail for the purpose of establishing the work activities commonly performed. These work activities, and the appropriate work units which would represent the output resulting from those activities, were reviewed and approved by each supervisor concerned.

A random sampling schedule of visitations was developed covering a period of eighteen weeks. With the use of appropriate data sheets, observations were made of the

activities being performed at random times in each of the approximately two hundred positions.

The percentage occurrence was determined for each work activity. Simultaneously, the output of work units by each worker was recorded, in addition to the total time devoted to the production of these work units. For "direct work activities," for which there were countable work units, a standard was calculated by multiplying the percentage occurrence by the total working time, and dividing this product by the number of work units produced in the performance of that work activity. For "indirect work elements," for which there were no countable work units, suitable allowances were determined directly from the occurrence percentages developed for those elements.

A comprehensive reporting system was developed to provide the several levels of management with periodic reports on individual work center effectiveness.

The study results indicated that, if properly introduced and conducted, the work sampling technique provides an effective method for establishing the precise standards necessary for effective managerial control of office work performance. Microfilm $2.65; Xerox $9.20. 203 pages.

WEAPON SYSTEM MANAGEMENT

(L. C. Card No. Mic 59-419)

William John Reckmeyer, Ph.D.
The Ohio State University, 1958

Recent international developments have emphasized the economic, political, and social threat with which the United States is faced. This threat is most overt when expressed in military terms. The United States must have strength comparable to that of her enemies in order to counteract this threat.

Our national policy, which leaves the initiation of military action to the enemy, emphasizes the necessity of maintaining a striking force adequate to discourage aggressive intentions. The expense of maintaining a high state of combat readiness restricts the size of our forces to the minimum considered nationally practical. It is mandatory therefore that every element of our military force always be capable of maximum exploitation of the current military situation.

The above forces a conservative approach in modernizing our force. The accelerated rate of technological advance and the resulting increases in military capability are apparently in direct conflict with such conservatism. The only solution is the astute management of our time, efforts, and resources. Such management is necessary in order that a complete weapon enter the active inventory not earlier than it can be truly operational, but also not later than the same date lest we fall behind in level of capability vis-a-vis the enemy.

This management requires an understanding of the principles of management, of background history, and of empirical data concerning present activities. Together this information will make possible improved management in the future. The dissertation therefore attempts to restate these principles; to indicate the background circumstances relating the activities of American Government and American industry in the development, procurement, production and logistic support of airborne instruments of combat and all necessary related equipments; and to indicate the problems experienced and the methods utilized to resolve these problems during the life span of such an instrument now normally referred to as a weapon system.

In implementing the concept, the most readily recognized area of change concerns organizing. In this respect the fundamental change is that of establishing strong project elements with responsibility and authority commensurate in scope with the functional management personnel. This change is a reflection of the increased scope of difficulty involved in managing weapon systems. It also reflects the basic decision of the USAF to decentralize responsibility and allot an increasing degree of it to industry. This decentralization emphasizes the administrative management functions of the USAF.

Specific areas of difficulty identified by industry include the determination of the objective (threat), sales, purchasing, quality control, personnel, finance and development-production. It is significant that the major problem area of administrative control and coordination had not yet been identified as the focal point of the management problem at the time of this study. The methods of resolving the identified problems and their impact on the management functions of creative planning, organizing and controlling are discussed.

A synthesizing and an evaluation of these factors and circumstances are the basis for improved weapon system management. Such improvement requires that the Federal Government truly expand the scope of the concept to other services within the Department of Defense and expand its participation in applied research programs. It also requires that industry itself think and act more completely as a weapon system integrator. When this is accomplished we will have made a major forward step toward improving management--in increasing the effectiveness of our national defense effort through decentralized weapon system management. Microfilm $4.60; Xerox $15.40. 359 pages.

MANAGERIAL GROWTH AND DEVELOPMENT: A TENTATIVE EXPLANATION OF THE INCREASING USE OF MANAGERIAL MANPOWER IN COMPARISON TO TOTAL MANPOWER

(L. C. Card No. Mic 58-7896)

C. Edward Weber, Ph.D.
Princeton University, 1958

The study explored some of the conditions which may have induced five expanding firms to increase their managerial employment relative to other employment. Managerial employment was defined to include approximately those persons who participated in the functions of planning, innovation, coordination, control, and routine supervision of the enterprise.

The analysis was based upon information derived from employment statistics and interviews, and its purpose was to obtain tentative hypotheses relating to the relative expansion of managerial employment. The change in the companies' employment patterns was determined from data covering the number of managerial and non-managerial employees in the various divisions of the companies.

A knowledge of the patterns of change made it possible to direct the interviews to those parts of the companies which accounted for the relative growth of managerial employment. The interviews of which there were approximately fifty were the primary source of information on the underlying conditions.

The evidence which was obtained from the study suggests that economic change may be a primary factor underlying the growth of executive, administrative, and technical manpower in comparison to clerical and manual manpower. The economic changes may take the form of the expansion in output, the rising cost of labor, material and capital, the intensification of the competitive situation, and the necessity to develop new technologies and products. The relative size of managerial employment may increase, first, because the factors may induce a rise in the proportion of managerial personnel utilized in a particular operation and, secondly, because the factors may induce the growth of management intensive operations as compared to less intensive operations. The impact of economic change may be reinforced by the necessity to accommodate to the work force, unions, and other groups and by the adoption of a professional approach toward managerial organization. Empire building may perhaps influence the relative growth of managerial employment, but counter pressures may be minimizing this influence.

One may not surmise, however, that there is a mechanistic or necessary relation between the factors included under economic change and the relative use of managerial resources. In some instances, the factors apparently do not cause an increase in the proportion; but these are perhaps the exception. Where economic change is associated with a rise in the managerial proportion, one may suggest that the particular change increases the managerial effort by generating a greater number of problems or more complex problems or reduces the clerical and manual effort by merchanizing and reorganizing the clerical and manual work operations.

Furthermore, the source of the relative managerial growth may lie in management, itself, when the economy is viewed as a whole. Economic change, in large measure, may be the result of innovation, especially if innovation is broadly defined to include modifications of merchandising, administrative, and other techniques. Consequently, a situation may be created where economic change and the relative growth of managerial employment reinforce each other. Economic change induces the relative expansion of managerial employment, and the expansion of the managerial organization induces economic change. It is submitted, therefore, that innovation and adaptation to innovation may be a fundamental force underlying the comparative growth of managerial employment.

Microfilm $2.90; Xerox $10.00. 224 pages.

ECONOMICS, FINANCE

AN EVALUATION OF THE VOLUNTARY CREDIT RESTRAINT PROGRAM OF 1951-1952

(L. C. Card No. Mic 58-7905)

Carl Theodore Brehm, Jr., Ph.D.
Indiana University, 1958

The Voluntary Credit Restraint Program of 1951-1952 was an attempt to control the level and direction of lending through the voluntary cooperation of financial institutions. Commercial banks, insurance companies, investment bankers and other financial institutions were urged to lend only for defense and defense related purposes and for essential civilian needs. It was hoped that thereby inflationary pressures would be curbed or at least reduced and funds would be made available for the financing of defense projects. It is the purpose of this dissertation to evaluate the effectiveness of the program and to determine the appropriate role and goals of the program with particular reference to commercial banks.

Historical materials and analytical models are used to provide the foundation for the evaluation of the program. From this material it is found that if the central bank makes reserves freely available to the banking system then the program may limit credit expansion only if the definition of eligible loans is so strictly drawn that loan opportunities are limited in quantity. If reserves are not easily available to banks then the program serves as a guide to lenders in rationing credit to borrowers. The degree to which this can be successfully done depends upon how concretely loan eligibility is defined.

An analysis of the program's criteria indicates that they were so generally drawn that it would be difficult for the program to achieve any degree of success either as a limiter of loan volume or as a rationing device. The conclusion is also reached that it would be difficult to establish a set of loan criteria which would fulfill these objectives.

The Voluntary Credit Restraint Program also poses the public policy question of the effects which may follow from the administration of the program by an essentially private group of businessmen. The rationale for this was that financial institutions will cooperate better if they are asked to voluntarily participate in the program than if they are compelled to follow a set of governmental regulations. However, it is found that there is no reason to assume that the activities of the volunteer group can be any more effective than those of a governmental group and in fact the private volunteer group may or may not be coordinated with the overall economic control program. Furthermore the practice of giving regulatory duties without responsibility to a private group carries wider implications for public policy and poses a threat that whatever competitive forces may exist in an industry may be reduced or destroyed by such practices.

Finally there is the question of whether commercial bankers did in fact cooperate with the Voluntary Credit Restraint Program. Although there is little substantial evidence to support either side of the question some conclusions can be drawn by examining the market structure of banking and related markets. It is concluded that among smaller banks the relevant market is essentially local and oligopolistic and hence knowledge concerning each rival's activity should be relatively better than if there were many

rivals; although even in this situation there is not absolute certainty that each is complying with the program. In regional and national loan markets where both lenders and borrowers have more numerous opportunities the analysis suggests that there is less probability of cooperation with the program. The conclusion is thus reached that the cooperation of the bankers with the program could only be assured under very special circumstances, such as an extreme national emergency of some kind.

Microfilm $3.10; Xerox $10.60. 239 pages.

INCOME TAX COMPLIANCE OF FARM INCOME

(L. C. Card No. Mic 58-7484)

Wayland Downing Gardner, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Harold M. Groves

The suspicion is widespread that farm income succeeds in evading a large part of its proper tax liability. To a considerable extent, this suspicion arises from the recognized difficulty in administering income taxes in agricultural areas. In fact, it is frequently contended that income taxes cannot play much of a role in areas where farming is important.

This research undertook to measure the income tax compliance of the income of 364 farms in three southern Wisconsin towns (townships). The study was based on the requirements of the Wisconsin income tax and dealt with the years 1954 and 1955. Although its primary purpose was to establish quantitative estimates of income tax complicance, considerable attention was given to the diagnosis of the causes of non-compliance and to the prescription of measures for improvement. Indeed, part of the justification for undertaking an intensive study of a small area lay in the desire to achieve some qualitative insight into the problems of administering income taxes on farm income.

The chief task in measuring compliance lay, of course, in the establishment of a reliable estimate of reportable farm income. In this study, the aim was to relate income estimates as closely as possible to the productive capacity of the farm as indicated by the property tax assessment. A separate estimate of gross receipts was made for each of the more important income sources of the farms studied. Source material for these estimates came from (a) data on sales and payments collected directly from government agencies and from purchasers of farm commodities in the area, and (b) from published statistics on agricultural markets and prices. Farm deducations were estimated on the basis of an average ratio of deductions to gross receipts derived from certain 1954 tax returns which had been filled out under the supervision of officials from the University of Wisconsin College of Agriculture.

When aggregate income estimates had been established, compliance was determined by comparing these amounts with those actually reported from the farms studied. Compliance, itself, was a percentage which expressed the amount reported in terms of the amount which should have been reported.

According to these procedures, it was estimated that the farmers studied had reported 65.3 per cent of their reportable farm income and that the tax paid on farm income was not more than 65.3 per cent of what should have been paid. Non-filing was estimated to have been responsible for 21 per cent of the unreported farm income and for 13 per cent of the unpaid tax.

Interestingly enough, the evidence showed that both gross receipts and deductions were under-reported on the returns studied. This indication that no aggregate evasion arose through the over-claiming of deductions provided one of the major bases for the conclusion that the chief cause of farm non-compliance lay in the inadequacy of farm accounts and of the farmer's knowledge of tax requirements. In general, compliance was higher for those items on which better farm accounts were maintained.

In view of this diagnosis, recommendations were made for improving the quality of the farmer's voluntary self-assessment and for assisting the tax department in auditing farm returns. Foremost was the recommendation that the tax department obtain source information from the various purchasers of farm commodities. Also, it was recommended that taxpayer assistance programs should be directed at aiding the farmer in keeping those accounts necessary for the proper reporting of income, and that property tax records should be utilized in identifying farmers under an obligation to file an income tax return.

Microfilm $3.35; Xerox $11.40. 260 pages.

HISTORY AND DEVELOPMENT OF CORPORATION NET INCOME TAXATION IN THE STATE OF NEW YORK

(L. C. Card No. Mic 59-451)

William Franklin Railing, Ph.D.
Cornell University, 1958

This study is concerned with the history and development of the taxation of corporation net income by the state of New York under Article 9-A of the tax law. All business corporations subject to taxation upon their net income are assessed under it with the exception of banking institutions, which are taxed by Articles 9-B and 9-C.

The author began by describing how corporations were taxed from 1665 to the enactment of Article 9-A in 1917. At first, the general property tax was applied to corporations. Because this was unsuccessful, the franchise tax laws of 1880 were passed which taxed foreign and domestic corporations doing business within the state upon their capital stock. Savings banks and institutions for saving, commercial banks, and mining and manufacturing corporations were excepted. In 1896, the corporation franchise taxes were codified under Article 9 of Chapter 60 of the Consolidated Laws.

With the passage of Article 9-A in 1917, net income was adopted as a base for franchise taxation. The new impost was levied on domestic and foreign corporations for the privilege of exercising their charters and for the privilege of doing business within the state, respectively. Article 9-A was not technically a direct impost on corporate income, but a franchise tax. Entire net income was merely the measure of the tax and not the subject. The courts therefore have held that certain items of ordinarily tax-exempt income, such as the interest from

federal obligations, could be included in entire net income.

Entire net income was presumably the same as that income which the taxpayer reported to the federal government. There were, however, certain differences; for example, New York did not allow the deduction of net operating losses for prior years and included the income from state and local obligations.

A corporation that conducted business within and without the state was taxed only on that part of its income earned within New York. This was found by multiplying its entire net income from all sources by an allocation percentage composed of the average proportion of the following assets of the corporation located within the state: (1) real and tangible personal property; (2) bills and accounts receivable; and (3) the stocks of other corporations.

The rate of the tax, which was three per cent in 1917, has risen as high as six per cent.

In 1944, Article 9-A was revised in order to remove inequities and assure a fair distribution of the corporate tax burden. Entire net income was changed to allow the deduction of fifty per cent of non-subsidiary dividends and all receipts from subsidiary capital.

Every corporation subject to taxation under the new Article 9-A was required to pay: (1) a tax on its entire net income allocated to New York; and (2) a tax on its subsidiary capital allocated to New York. Entire net income was divided into "business income" and "investment income" for the purposes of allocation. Business income was allocated by the average of the New York percentages for three factors: (1) real and tangible personal property; (2) business receipts; and (3) total payroll. Investment income was allocated by a percentage determined by the proportion that the taxpayer's investments, as allocated by the issuing corporation's allocation percentage for the previous year, bore to the taxpayer's total investments exclusive of cash and obligations of the United States. The subsidiary capital allocation percentage was based on the average of the New York State allocation percentages of the taxpayer's subsidiaries for the previous year.

The new Article 9-A, as amended since 1944, is the present New York franchise tax on business corporations.

Microfilm $7.15; Xerox $23.80. 564 pages.

A CASE STUDY IN THE MEASUREMENT OF GOVERNMENT OUTPUT

(L. C. Card No. Mic 58-7895)

William A. Vogely, Ph.D.
Princeton University, 1958

The Bureau of Land Management, United States Department of the Interior is studied to explore ways of making useful measures of results of the activities of a government agency. The first step is to survey the activities of the Bureau to find what the Bureau does, and the second step is to prepare exploratory measures of the results of the activities.

The activities fall into several major programs--- minerals, lands, grazing, and forestry. For each of these programs, results are considered from several standpoints--- the value of the program to the economy as a whole, the amount of subsidy to private groups, fulfillment of specific Congressional mandates (chiefly in the forestry program), and efficiency in carrying out particular activities.

The different measures of output are pertinent to different problems of choice. The value of an activity to the economy as a whole bears on the choice of programs that are economic, and to the extent that economic efficiency is the criterion, on the combination and sizes of programs to yield the greatest gain at a given cost. The subsidy given to private groups affects the distribution of income of the nation and is relevant to the choice of continuing, modifying, or eliminating a particular program. Congress may direct a bureau to undertake a specific activity which cannot be judged by a relevant economic criterion, and it is pertinent to measure such programs from the standpoint of fulfilling Congressional mandates. Estimates of physical product (such as cases closed), output per man-hour, or unit costs of certain activities help point to more efficient ways to conduct a program.

Such measures are developed for the four programs of the Bureau of Land Management. Based upon the results of these measures some conclusions are derived about the size, usefulness, and efficiency of the Bureau's operations under these programs. For example, the mineral-leasing program of the Bureau is obviously worth continuing as it produced in 1953 an output of from 65 to 95 million dollars at a cost of about one-half of a million dollars. Under this program a subsidy (not intended by Congress or previously estimated) of from 16 to 43 million dollars was given to those persons holding the mineral leases in 1953. On the other hand, the study shows that the return on the cumulative investment in the grazing program from 1934 to 1953 is less than 2 percent, and the return on a projected 450 million dollar improvement plan would be less than 2/10 of 1 percent, indicating that some past investments were poor ones, and that the projected improvement plan cannot be justified on economic grounds.

The most important conclusions from the study pertain to the feasibility of measuring government output in general. The study develops a few new techniques or procedures that can be useful for general measurement and illustrates how measures that shed light on some particular problem can be derived. All-purpose measures are usually not possible and estimates of output and cost differ for different problems of choice. It is concluded that the outlook for quantitative measurement of government activities is not bleak and a good deal more can be done than has been done in the past.

The study indicates, it is hoped, that a single researcher can make useful progress in this area in a reasonable length of time and that further research effort to measure public output is warranted and has promise of a valuable outcome. Microfilm $2.50; Xerox $8.80. 191 pages.

GOVERNMENT SPENDING: PROCESS AND MEASUREMENT

(L. C. Card No. Mic 58-7897)

Murray L. Weidenbaum, Ph.D.
Princeton University, 1958

An examination of the major phases of the Federal Government spending process reveals that the economic impact of government spending may occur during any of the phases of the process.

These phases are (1) granting of financial authorizations by the Congress, (2) placing of contracts with business firms, (3) production of goods and services and (4) delivery of the items to the Government and payment therefore.

Under certain circumstances, the announcement effects of the newly-granted obligational authority may cause an increase in private spending in advance of the placement of contracts or expenditure of funds. More usually, economic activity will be affected soon after the contracts are let, as private production gets underway. This production on government order will be recorded in the national income accounts as increases in gross private domestic investment (change in business inventories).

Only as production is completed and finished items delivered to the Government will the transaction appear as a government purchase. The delivery will be treated simultaneously as a decrease in gross private domestic investment; no net effect will occur in the level of gross national product at this point. The contribution will have been made earlier, during the production period prior to the actual government expenditures.

However, the mere granting of appropriations and the placement of contracts may have little effect on the level of production when resources are fully employed. Also, to the extent that government orders can be filled out of existing inventories, the effect on production may not occur until the depleted inventories are restocked. Despite these and other complications, the primary impact of government procurement on the level of economic activity usually occurs in advance of the actual government expenditure.

Government spending for other than the acquisition of goods and services may approximate more closely, or even lead, the economic impact. This ordinarily would be true for transfer and interest payments and grants to State and local governments where the contribution to economic output would be made as the funds are respent. This would also hold for lending programs, except where production is begun on the basis of the Government's commitment to lend at a later date. Purchases of existing assets merely add to the liquidity of the recipients, unless the proceeds are used to purchase or finance current output.

The generally used measures of Federal spending cover only the completion phase of the spending process, represented by disbursements or deliveries.

Measures of some of the other stages of the process can be obtained or prepared. Data on budget authorizations granted by the Congress can be secured annually from the budget document. Information on contracts let and other "obligations" incurred by Federal agencies is gathered for internal budgetary purposes but is not aggregated. There are no current data on production on government account as reports on inventories do not reveal the amounts relating to government orders.

Of these gaps, the one most readily filled is a current series on "obligations" incurred by the Federal Government which can be prepared from operational data.

Measures of the early stages of the government spending process can be used for many purposes of economic analysis. They are lead series which quickly register changes in demand and indicate future trends in governmental disbursements. They can also be used to evaluate developments in the economy during periods when changes in government purchasing exercise any important role.

The possibility of economic effects occurring during the various phases of the government spending process necessitates taking measurements of the spending stream at earlier points than merely the completion stage. What is needed is not a single measure of Federal spending but a tool kit of series, each of which is useful for certain purposes. Microfilm $3.75; Xerox $12.80. 292 pages.

ECONOMICS, HISTORY

THE OPERATION OF THE RIGHT TO WORK LAWS

(L. C. Card No. Mic 58-5337)

Father Joseph Richard Dempsey, S.J., Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Edwin Young

There has been a great amount of literature written about the philosophy behind the Right-to-work Laws. Some attempts have been made to study the effects of these laws. The burden of this thesis is to study the operation of the Right-to-Work law. The question treated is: Has the Right-to-Work law operated in the way that its sponsors said that it would?

The legislative intent of these laws was to prevent the execution of compulsory union contracts. A study of the legislative history of the Right-to-Work law in Louisiana and other states show this. Business interests pushed the passage of these laws in the name of freedom of choice. The constitutionality of the Right-to-Work law was tested on the basis of the enforceability of a union shop contract.

A study of the court cases arising under these laws shows that often they operate in the contract situation. However frequently enough these laws are used first to prevent organizational picketing. Secondly, they have been interpreted to make exclusive bargaining illegal. Thirdly, the protection given the union man under the provisions of these laws is not as extensive as that given the non-union man.

There are two threats to the operation of these laws beyond the announced intention of the legislature. First there is the doctrine of preemption. This would prevent the state courts from enforcing the state laws. Secondly is the operation of the Amended Railway Labor Act of 1951. This prevents the Right-to-Work law from modifying a union shop clause in a railway union collective bargaining contract.

The conclusion reached in the thesis is contrary to the announced intention of the legislature. These laws are used to interfere with the growth of unionism and collective

bargaining and they give a chance to some judges to legally justify their individualist and anti-union philosophy.

Microfilm $2.75; Xerox $9.40. 210 pages.

ECONOMICS, THEORY

THE WAGE-PRICE ISSUE: A THEORETICAL ANALYSIS

(L. C. Card No. Mic 59-937)

William G. Bowen, Ph.D.
Princeton University, 1958

The purpose of this dissertation is to make a limited contribution towards a fuller understanding of a widely discussed, highly controversial, and poorly defined subject --which, for want of a better short-hand expression, is referred to simply as the "wage-price issue." In brief, the wage-price issue encompasses the whole complex of questions involved in the allegation that the wage and price setting institutions of the contemporary American economy impart an upward bias to the price level. Express recognition of the limited nature of the intended contribution stems primarily from the inescapable fact that there are three broad sets of questions implicit in the wage-price issue--namely, a theoretical set, an empirical set, and a public policy set--and that this dissertation deals only with the theoretical set.

Organizationally, this inquiry is divided into five parts. Part I ("The Wage-Price Issue and the General Theory of Inflation") is devoted to describing the importance and evolution of the topic, to exploring the nature and origins of inflation, to identifying the "type" of inflation at the root of the wage-price discussion, and to investigating in some detail one particular model of the inflationary process--namely, the familiar "dilemma model" in which it is asserted that "spontaneous" increases in labor costs instigate a train of events which force society (and especially the monetary authorities) to choose between inflation and unemployment. This basic model is at the very heart of the wage-price issue, and the remainder of the dissertation is devoted to exploring the questions raised by this schema.

Part II concentrates on the wage determination aspects of the dilemma model. In this part an attempt is made: to evaluate the probable effect of various economic factors --productivity, excess-demand for labor, ability-to-pay, cost-of-living, and wage comparisons--on the magnitude of wage adjustments; to appraise the significance of certain institutional factors such as unionization and the characteristics of the wage-setting process; to describe the way in which these factors interact within the confines of the individual firm; and, finally, to analyze the factors which influence the behavior of "the general wage level."

Part III deals with the cost and price determination aspects of the dilemma model. In this part, an examination of the links which connect wage adjustments, unit labor costs, and unit total costs is followed by an analysis of micro-economic price theory in general, and the impact of costs on prices in particular. The cost-plus pricing controversy is briefly reviewed, and an attempt is made to analyze the way in which considerations such as public opinion, uncertainty, and the existence of the cost accountant modify the picture of price behavior derived from the traditional theory of the firm. Finally, certain more aggregative models of price behavior are appraised, and the proximate determinants of variations in the general price level are discussed.

Part IV is devoted to an analysis of the monetary policy questions which arise out of the dilemma model. Here the main issues discussed include: the general role played by the monetary environment in translating wage adjustments into changes in aggregate monetary demand; the "natural" barriers to inflation which operate in spite of an "elastic" monetary policy; the widely debated issue of the effectiveness or modus operandi of a restrictive monetary policy; and the significance of governmental interest in the level of employment for price level movements.

Finally, in Part V, an attempt is made to draw together some of the main findings which stem from the preceding chapters and to offer a few observations on the general problems of affixing the "responsibility" for inflation and "solving" the wage-price issue.

Microfilm $7.20; Xerox $24.80. 568 pages.

SOME THEORETICAL IMPLICATIONS OF THE WEALTH-SAVING RELATIONSHIP

(L. C. Card No. Mic 58-7832)

Arnold Collery, Ph.D.
Princeton University, 1958

Many economists argued in the nineteen thirties that an economy with flexible wages and prices could be in a state of continual unemployment. Professor A. C. Pigou and others challenged this view. They argued that the real money supply increases as wages and prices fall and insisted, in addition, that aggregate real demand was directly related to the real supply of money. Thus a fall in wages and prices increases aggregate real demand and employment.

Since that item an increasing amount of literature has appeared which refers to Pigou, real-balance, asset, wealth, and real-money-supply effects. Although many economists speak of a real money supply and real balances, their analysis indicates that it is wealth which is intended. Those who use these terms are thus arguing, as Pigou intended, that there is an inverse relationship between wealth and saving. The large number of terms for the same thing has caused considerable confusion among economists.

Don Patinkin, Lloyd Metzler and Abba Lerner have derived other interesting results from models which contain a relationship between wealth and saving. There are, however, implications not yet present in the literature. The wealth-saving relationship has definite implications for the theory of the adjustment mechanism in international trade. In a world of rigid prices reparations payments can always be made in goods and services if the government of either the paying or receiving country permits the intial transfer of gold or bank balances to affect the wealth of its citizens. Until the reparation is made in goods and services the wealth in either or both countries will be changing

and thus imports and exports and the trade balance will be influx. Only when the trade deficit of the receiving country caused by the transfer is equal to the value of the transfer will the economies be in equilibrium.

The wealth-saving relationship also has interesting implications for the quantity theory of money and the classical view that the equilibrium interest rate is unaffected by the quantity of money. These two propositions hold under more restrictive conditions than usually considered necessary. Increases in the supply of money which are not proportional to increases in the value of net claims against the government (wealth) will always lead to a change in the equilibrium interest rate and a less than proportional change in the price level, since the degree of disturbance in the money market will not be in proportion to the disturbance in the goods-and-service markets. For example, an increase of the money supply generated by lowered reserve requirements will lead to higher prices under conditions of full employment and make the public feel poor, since the unchanged nominal value of the public's claims against the government are now worth less. The reduction in the wealth of the public will increase the desire to save and thus lower the equilibrium interest rate.

Microfilm $2.00; Xerox $5.80. 119 pages.

WELFARE ECONOMICS AND GOVERNMENTAL PROGRAMS WITH AN APPLICATION TO HIGHWAY FINANCE

(L. C. Card No. Mic 59-391)

Milton Zach Kafoglis, Ph.D.
The Ohio State University, 1958

Highway and many other governmental programs are financed through a combination of prices and taxes. However, price structures cannot be related consistently to tax structures until price and tax standards are defined and, if possible, reconciled. This study examines the relationship between price and tax standards and attempts to establish economic criteria for the combination of prices and taxes into a single financial structure. The criteria as developed are applied to highway financial programs.

The attempt to develop criteria relies on the analytical procedures of modern welfare economics. There are three important elements in this approach: (1) the removal of interpersonal comparisons of utility, (2) the conception of social welfare as a function of individual welfare, and (3) the evaluation of public policy in terms of a "compensation principle" which requires that the net gains to individuals be positive.

Removal of interpersonal comparisons limits the scope of the analysis to those governmental revenue-expenditure programs which do not seek explicitly to correct or alter the distribution of income. This limitation precludes a complete description and analysis of the relationship between price and tax standards because it shifts attention from equity to economic efficiency. On the other hand, there are certain advantages in this approach. The conception of social welfare as a function of individual welfare emphasizes the relationship of taxation and public expenditure to the economic welfare of individuals. The compensation principle makes possible a balanced approach which recognizes the gains from public expenditure as well as the "burdens" imposed by taxation.

With these basic ingredients, the analysis develops a "voluntary exchange" theory of taxation similar to that advocated by the Swedish School of economists led by Knut Wicksell. According to this theory, rates of taxation and amounts of public expenditure are established through voluntary exchanges or bargains made by individuals acting in a collective context. One of the contributions of the study is the incorporation of the voluntary exchange theory into the structure of modern welfare economics. This theory combined with the marginal cost standard provides a unified and consistent framework for the determination of prices and taxes.

Application to highway programs leads to a revised theory of highway finance and to a solution of some of the problems of highway financial analysis. Evaluations in terms of the voluntary exchange theory indicate that the traditional allocation of cost between the users and nonusers of highways may lead to an economically inefficient allocation of resources. In making such allocations care must be exercised to avoid transferring income from nonusers to the operators of private and commercial vehicles through a subsidy disguised in the form of a legitimate nonuser share. The conditions under which a nonuser share is appropriate are described in detail.

Evaluations in terms of the marginal cost standard indicate that the incremental cost technique currently employed for allocating cost among highway users rests on solid theoretical foundations. However, most applications do not distinguish carefully between common, joint, and special cost. Neglect of these logical distinctions introduces arbitrary judgment leading to an unnecessarily complex allocation of cost.

Speculation concerning the impact of marginal cost pricing for highway services suggests the possibility of establishing the gasoline tax rate so that gasoline tax "earnings" on primary or heavily traveled roads would cover primary road common cost. Additional pavement cost of primary roads may be recovered through the use of graduated license or, preferably, weight-distance charges. Lightly traveled or secondary roads may be financed through the use of gasoline tax "earnings" supplemented by flat-sum license taxes. This general solution creates no new administrative problems and indicates the possibility of an economically efficient highway structure. Microfilm $4.80; Xerox $16.20. 376 pages.

A CRITICAL STUDY OF RECENT CONTRIBUTIONS TO THE THEORY OF WELFARE ECONOMICS

(L. C. Card No. Mic 59-49)

Toshinosuke Kashiwazaki, Ph.D.
The University of North Carolina, 1958

Supervisor: Ralph William Pfouts

In spite of its expressed object, welfare economics has made only minor contributions directly towards the making of welfare-promoting policy. Is this because welfare economics may have some fundamental defects inherent in itself or in the foundations on which it is built? Or, is it

due to the unfitness of the analytical tools used for resolving problems? These questions led the writer to examine various systems of welfare economics, and elucidate the significance of theories of welfare economics, which have been developed during the past two decades. Our main purpose is to evaluate contributions to the subject, with special reference to their underlying assumptions, so as to be able to discern what has been contributed over what had been done by the Pigovian welfare economics, and to suggest some directions in which future developments could be successfully made.

Our evaluation proceeded by distinguishing two levels of welfare analysis according to the nature of value judgments required. The first is that level of analysis which is solely based upon "weak" value judgments in that they are almost unanimously accepted in our society. The second level of analysis, on the other hand, is characterized by the introduction of "strong" value judgments in that they have no guarantee of being accepted unanimously in our society. The distinction enabled us to classify various systems of welfare economics in a clear-cut way, and also to see if particular systems are logically consistent, particularly with respect to the derivation of policy recommendations. We employed the distinction throughout our study into the three types of problems, which constituted the main theme in our study. They are (i) the "timeless" problem of allocative efficiency and distributive justice, (ii) the "timeless" problem of the degree of utilization of resources, and (iii) the "long-run" problem of economic progress involving allocative efficiency and distributive justice over time.

Our main analytical techniques are the Bergson-Lange-Samuelson type of social welfare function and an economic model of perfect competition, the workability of which constituted the minor theme in our study. The social welfare function concept, combined with our distinction between the two levels of welfare analysis, enabled us to specify the stage at which a "strong" value judgment is required. The economic model of perfect competition is useful in that it produces a Pareto-optimum, with which the New Welfare Economics was concerned. An effort was made in exploring the theoretical framework of the New Welfare Economics based on "weak" value judgments alone in its relation to the strong motivation for making policy recommendations. The significance of the New Welfare Economics then lies in the fact that it restated some welfare propositions which are capable of being applied to particular problems. Those applications represent the piecemeal approach in that only segments of an economy could be profitably considered, and that conclusions reached are relative to the distribution of income assumed.

Our examination of several criticisms of the economic model of perfect competition based on (i) the distributive point of view, (ii) the external economies and diseconomies argument, (iii) the viewpoint of monopolistic competition, (iv) the viewpoing of utilization of resources, and (v) the viewpoing of economic progress, made it clear that a different theoretical framework can be made according to specific purpose for analysis in hand, in which differently specified factors affecting welfare are included in the social welfare function. The general conclusion of this study is that many of the so-called "failures" of our current welfare economics could be remedied by deriving new formulas or by explicitly introducing "strong" value judgments, and others could be resolved by empirical inquiries.

Microfilm $3.85; Xerox $13.00. 298 pages.

THE FINANCIAL SYSTEMS OF CHILE AND MEXICO: THEIR ROLE IN ECONOMIC DEVELOPMENT, 1945-1955

(L. C. Card No. Mic 59-422)

David Howard Shelton, Ph.D.
The Ohio State University, 1958

The dissertation is concerned with the interrelations between the development of the financial systems of Chile and Mexico and the growth of their "real" economies. It covers the years 1945-1955. The analysis begins from a relatively simple theoretical position, considers the recent experiences of Chile and Mexico in a form susceptible of comparison with this position, and trys to reconcile experience with theoretical expectations.

Economic growth is probably the pre-eminent economic goal of Chile and Mexico. It is defined, for purposes of this study, as the progressively greater realization of the full potential possessed by the nations' resources for creating real income. Economic growth is presumed to be evidenced by rising output of goods and services per capita. Where economic growth is a goal of a society, it is suggested that the growth objective be a rate of increase in real output per capita which is as rapid as may reasonably be expected to continue in the foreseeable future, and which is consistent with the society's free and informed choices between work and leisure, between present and future consumption, and among the various goods and services which might be produced and consumed. No attempt is made to give growth a position of primacy among the wide range of goals which might be sought.

As a basis for treatment of Chile and Mexico, two assumptions are set up regarding the interrelations among economic growth, the financial system, and capital accumulation. These assumptions are that the rate of capital accumulation is a direct determinant of the rate of growth of real output; and that certain types of expansion and diversification of the institutions composing the financial system tend to facilitate capital accumulation. Discussion of these assumptions and of the experiences of Chile and Mexico are directed not at attempted "proof" of the assumptions but at providing a basis for regarding them as reasonable, and at determining the degree to which events in Chile and Mexico bore out the expectations flowing from them.

These nations' experiences do not "prove" anything with respect to the relations between growth of the financial systems and growth of real output. It is interesting and possibly dignificant that, in Chile, comparatively slow growth of total output, stagnation of output per capita, rapid inflation, virtual ossification of the non-bank segments of the financial system, and a low rate of capital formation were associated. In Mexico, rapid growth of both total and per capita output, moderate inflation, rapid expansion and diversification of the financial system, and a higher rate of capital accumulation accompanied one another.

The study seems to support a definite position with respect to the relations among capital accumulation, real income, and the development of the financial system. This position is that (1) the rate of capital accumulation seems to be a determinant of the rate of growth of real income; (2) expansion and diversification of many of the institutions comprising the financial system seem to favor capital accumulation; and (3) reasonable stability of the purchasing power of a nation's monetary unit seems necessary to

the expansion and diversification of almost all types of financial institutions except commercial banks.

Microfilm $4.55; Xerox $15.20. 354 pages.

LOCATION-SIZE THEORY FOR MULTIPLE-SOURCE, NONCLUSTERED INDUSTRIES

(L. C. Card No. Mic 58-1169)

Miles Harry Sonstegaard, Ph.D.
University of Oregon, 1958

Adviser: Robert Campbell

Interrelated decisions on plant location and plant size must be made by an investor before he constructs a manufacturing plant. Because the economics--particularly the micro-economics--of the joint location-size problem has received little attention in the literature, this study seeks to develop a framework for location-size theory and to illustrate a preliminary fitting of this theory to a practical problem. This study is oriented primarily to manufacturing plants in multiple-source, nonclustered industries.

Investors considering the construction of a plant in a multiple-source, nonclustered industry face two problems that are of particular importance in this type of industry. These problems are (1) to locate a plant with respect to many, rather than just a few, material sources and/or consuming points and (2) to balance economies in processing, which increase with plant size, with economies in transportation, which decrease with increases in plant size.

The total problem of locating a plant may be divided into two parts, (1) the problem of choosing the optimum orientation base and (2) the problem of orienting the plant to the orientation base. By orientation base is meant the group of trading points (i.e., material sources and finished good markets) that the plant is expected to trade with. By orientation is meant the locating of the plant, with respect to a given orientation base, so as to maximize investor's surplus. A method of choosing the optimum orientation base is to consider the plausible orientation bases in turn, computing the optimum plant location for each orientation base. For each orientation base the local supply and demand curves existing at the trading points are estimated, adjusted for transfer costs to or from the plant, and aggregated to form material cost and demand curves applicable at the plant. The processing cost curve, which excludes any return on investment, is added to the material cost curve to get an average total cost curve. A multivariate model is set up to find investor's surplus for each orientation base.

An approximate criterion for orienting a plant to a given orientation base is that of minimizing average total transfer cost. The junction-of-strings theory for a uniform transport surface and the medical location theory for a cardinal uniform transport surface indicate the locations that meet this criterion. The existence of geographical variations in processing costs requires an economic balance between (1) deviation cost, which is the excess transfer cost of locating elsewhere than at the minimum-transfer-cost point and (2) the processing-cost advantage of the nonminimum-transfer-cost point. Further considerations are the planned level of output and type of geographical pricing policy. These considerations help determine both the optimum location and the amount of expected investor's surplus associated with each alternative orientation base.

Although plant orientation under a realistic assumption of fixed routes defies complete generalization, computation of investor's surplus for each plausible plant location for a given orientation base appears to be a practicable method in most situations. The use of gateway junctions, where appropriate, offers the possibility of substantial simplification.

This study illustrates techniques for a preliminary fitting of location-size theory to the practical problem of determining (1) the most plausible plant location in Arkansas for a vegetable oil processing plant and (2) whether such a plant at the best Arkansas location appears to be feasible at the present time. It is concluded that the likelihood of success for such a plant is sufficient to justify a more comprehensive study by a prospective investor.

Microfilm $4.65; Xerox $15.60. 363 pages.

EDUCATION

EDUCATION, GENERAL

A STUDY OF TEACHER ROLE EXPECTATIONS

(L. C. Card No. Mic 58-1171)

John Henry Chilcott, Ph.D.
University of Oregon, 1958

Adviser: Donald E. Tope

The Purpose

The purpose of this study was to determine the nature of teacher role expectations at the community level and to compare these expectations with teacher expectations of themselves and teacher perceived community expectations.

The Locale

The community under study was called Timber Town, a small city in the northwestern part of the United States. The community was available through the cooperation of the Northwest Regional Cooperative Program in Educational Administration located at the University of Oregon.

The Samples

Using a table of random numbers, a sample of twenty-five teachers listed in the school directory was chosen. Similarily using a table of random numbers, a sample of sixty residences in the community was selected from a larger sample of 505 residences taken from the city population by a Community Study Project two years prior. Such factors as refusal to be interviewed, vacant houses,

vacation periods, and no response reduced the original community sample to thirty one.

The Procedure

Two interview schedules were constructed, one for community residents and teachers, to learn their expectations of teachers. The second, for teachers, was worded in such a way as to glean the teachers' perception of community expectations.

The schedules were divided into seven sections each concerned with a phase of teachers expectations: demographic material on the interviews, stick drawing to elicit a teacher stereotype, qualities of a teacher, the teacher's behavior in the classroom and around school, the teacher's behavior in the community, teacher expectations considered important, and unstructured comments. A resident interview lasted from thirty to forty minutes, a teacher interview from sixty to eighty minutes.

Following a pre-test during which the schedules were revised, the interviews were conducted. The data was collected and tabulated. The X^2 test of independence was used to test relationships of community behavior to expected teacher behavior.

Conclusions

1. There was considerable evidence that teachers were being considered normal citizens of the community and as such could enjoy a considerable amount of freedom so long as they used discretion.

2. Though there were quite a few individual differences within the community, as a group they preferred teachers to: be older (35-50), dress conservatively both at school and in public, be friendly but not too friendly with their pupils, use a variety of teaching techniques in the classroom; be careful in discussing political, religious, and controversial topics in the classroom. The community preferred that their teachers not: smoke around school or in front of their pupils, drink except in the privacy of their homes, use profane language or tell "risque" jokes.

3. The expectations which the teachers considered important were quite similar to those which the community felt were important. In general, the teachers' expectations of themselves did not vary greatly from those of the community. They were, however, more restrictive than the community.

4. Teacher perception of actual community expectations were quite accurate. Teacher perception was poorest with regard to those community expectations from which teachers' expectations differed the most.

5. The individual behavior of the residents in the community with regard to drinking, smoking and church attendance tended to dictate the expectations of teachers with regard to these behaviors.

6. The traditional teacher stereotype had broken down in most respects and was being replaced by a different stereotype which still pictured a teacher as a woman and a church member but in other respects was quite different. There was some indication that the teacher stereotype of the future would be married women, attractive looking, neatly dressed and well groomed who enjoyed a considerable amount of community respect. The teachers were aware of this change in the teacher stereotype. People who associated closely with teachers seemed unable to describe a teacher stereotype.

Microfilm $2.65; Xerox $9.20. 201 pages.

A STUDY OF THE OUT-OF-SCHOOL EXPERIENCES OF SELECTED SECOND GRADE CHILDREN WITH IMPLICATIONS FOR REVISION OF THE SOCIAL STUDIES COURSE OF STUDY

(L. C. Card No. Mic 58-7913)

William Waldrop Crowder, Ph.D.
Indiana University, 1958

Purpose: This study was undertaken to explore the relationship of children's out-of-school experiences to their social studies curriculum.

Method: Two hundred and forty pupils in 12 elementary schools in a mid-west city were interviewed concerning their out-of-school experiences, and the accuracy of their reporting was checked by questionnaires sent to parents. The course of study for first and second grade social studies was examined to discover which of these experiences seemed to be recognized and incorporated into the suggested developmental activities. The attitudes of principals and teachers toward use of this course of study were also explored. Observations were made in 24 second grades to investigate the treatment of out-of-school experiences in the social studies class. Conclusions were drawn from these data, and their implications for possible revision of the second grade social studies course of study were explored.

Conclusions: Although children are having a wide variety of out-of-school experiences related to home and community life, other experiences, both real and vicarious, are taking them out of their immediate environment and providing contacts with people and places far beyond the local community. New developments in transportation and communication are the media for this widening of children's horizons. A careful study of the data, moreover, indicates that groups as well as individuals differ in the nature and range of their out-of-school experiences.

The survey of the course of study for first and second grades revealed that although many suggestions in this guide are closely related to the near-at-hand environment of children, a number of other important out-of-school activities, such as watching television, reading library books, going to the movies, entertaining visitors from other places, and travelling beyond the local community, are not emphasized. Neither the activity itself nor the environment it touched are drawn upon by the course of study suggestions.

Visits to social studies classrooms indicated that teachers vary widely in their treatment of children's out-of-school experiences, and that these experiences seem to play only a minor role in the social studies class.

Implications for Course of Study Revision: Since a course of study which limits children's study to the local community may be overlooking the fact that many children have had experiences in a wider environment, areas touched by certain of these out-of-school experiences which are not now a part of the course of study may be appropriate areas to consider in revision. Because experiences suggested in the course of study may not be challenging to those pupils who are having experiences beyond the local environment, the course of study should be flexible enough to give children an opportunity to bring their out-of-school

experiences into the social studies class and should indicate ways in which teachers may discover and draw upon these experiences.

Recommendations for Further Study: Before any conclusive statements can be made as to the appropriateness of extending the study of social studies in the second grade to environments beyond the local community, further study must be carried on to determine children's ability to understand these far-flung environments to which their out-of-school experiences may take them.

Microfilm $2.20; Xerox $7.80. 166 pages.

A STUDY OF TEACHING TECHNIQUES PRACTICED BY TEN SELECTED ELEMENTARY SCHOOL TEACHERS IN NEW YORK STATE AND THE FORMULATION OF CONCEPTS FOR THE POTENTIAL ADAPTATION OF THESE TECHNIQUES IN THE BASIC SCHOOLS OF INDIA

(L. C. Card No. Mic 59-122)

Durga Deulkar, Ph.D.
Cornell University, 1958

The purposes of this study was to investigate teaching techniques practiced by selected teachers in elementary schools in New York State, and to formulate criteria for their potential adaptation in Basic Education in India.

Basic Education with its fundamental concept of education through a productive craft embodies some of the basic principles of modern education--personality development, a democratic social order, harmonious integration of the individual and society through inculcation of the spirit of cooperation, and universal public education. A review of selected educational literature resulted in the delineation of the aims and objectives of modern education, dynamics of the learning process, human relations in teaching and learning, and principles of modern teaching techniques, such as core teaching, unit teaching, projects and activity program. The concepts of effective teaching determined through the study of the literature indicated the importance of: (a) involvement of the child's free, intelligent and active participation, (b) meaningful and purposeful learning experiences, based on the principles of integration, activity programs and assurance of the child's feeling of security and satisfaction through consideration of individual differences.

The selection of teachers was based on the criterion that they be among the effective teachers as rated by school administrators. The data were collected through techniques of observation and interview. The findings from the research as stated in terms of beliefs and practices of teachers were as follows: (1) direct subject-focused teaching, with emphasis on drill, is essential in effective teaching, (2) diligence in planning and organizing, teacher's skill and competences and a limited number of children with whom to work are prerequisites in effective activity program, (3) variety in teaching techniques is important for personality development, (4) teacher's feeling of security and of confidence is fundamental in effective teaching, and (5) special subject teachers contribute to the quality of teaching in their subjects and to the establishment of teacher-pupil rapport.

The Indian situation, characterized by an urgent trend toward improvement of the educational system both quantitatively and qualitatively, is necessitating an expediency program of training large number of teachers in the shortest possible time. The importance of strengthening the teachers' understanding of the concepts of Basic Education, particularly the role of craft in this education, cannot be minimized. The threat of a failure to integrate the basic precepts is that Basic Education would become so craft-centered as not to serve its true purpose. Furthermore, the shortage of teachers demands a shift system which allows teachers insufficient time for the planning and organization essential for an effective program. Resistance on the part of the teachers of the transfer of existing primary schools to Basic Schools is also a problem for consideration. In the light of these problems, the suggestions growing out of this study are: (1) utilization of intensive efforts in the organization of a few effective Basic Schools which might serve to establish the teachers' and parents' confidence in the system, (2) inclusion of demonstration lessons by specialists in Basic Education in the teacher training program to educate teachers in the skills of implementing the principles of Basic Education in teaching, thus encouraging their confidence, (3) utilization of special talent teachers in the organization of planning and teaching cooperatively to incorporate a variety of teaching techniques, (4) organization of intensive in-service training programs to educate the existing primary school teachers, (5) specific orientation of the teachers to the dynamics of interaction and the behavior and development processes of the child.

The concepts underlying Basic Education are fundamental to India's cultural needs. As a result of continuous research and the implementation of such research, the system of Basic Education would be strengthened and stabilized. Microfilm $2.55; Xerox $8.80. 194 pages.

SOME INFLUENCES OF EVALUATIONS ON THE SCIENCE AND MATHEMATICS PROGRAMS IN OREGON SECONDARY SCHOOLS

(L. C. Card No. Mic 59-650)

Clarence Edward Diebel, Ed.D.
University of Oregon, 1959

Adviser: Paul E. Kambly

This study is an attempt to determine some influences of the Cooperative Study of Secondary School Standard evaluations on the science and mathematics programs of fifty-seven Oregon high schools that were evaluated during the seven-year period 1950-1957.

The objectives, principles, and procedures of evaluations were established by briefly reviewing the history of the Cooperative Study; by relating the development of Evaluative Criteria; and by establishing the acceptance of the Cooperative Study.

The data needed for this study were obtained from the files of reports of evaluations made available to the author by the Oregon State Department of Education; from information obtained from questionnaires; and from information obtained through personal interviews. From the evaluation

reports in the State Department of Education the author obtained copies of the recommendations made to each school. The questionnaire returns furnished material concerning the implementation of the recommendations in the schools. Substantiating information as well as additional information was furnished by the interviews.

The 743 recommendations made for science and mathematics in the evaluation reports were classified into three main categories: (1) organization, (2) direction of learning, and (3) physical facilities. The number of recommendations made in any evaluation report ranged from two to sixteen but no attempt was made to determine an optimum number.

The degree or extent of implementation of recommendations was judged by principals, and by science and mathematics teachers on a five-point scale: (A) extensively implemented, (B) implemented to some extent, (C) implemented to a very limited extent, (D) nothing done, and (E) unacceptable. Principals and teachers did not completely agree in their judgments on the extent of implementation of recommendations as shown by graph style charts.

The reasons selected by principals and teachers for not implementing the recommendations extensively were checked on a nineteen item list. These nineteen reasons were then grouped into four categories: (1) nothing done, selected 26 times; (2) inaction, but interested, selected 189 times; (3) inadequacies or lacks, selected 248 times; and (4) apparently considering, selected 130 times.

Questionnaire and interview results show that a variety of lengths of time are required to plan for and carry out evaluation recommendations. Principals and teachers maintain interest in implementing recommendations for at least five years after the year of evaluation. Evaluation reports are referred to frequently by principals and they seem to be a source of discussion and planning at preschool fall conferences.

Some of the effects of evaluations in science and mathematics programs are quite evident when judgments on extent of implementation of recommendations, the reasons for not implementing some recommendations, and the time required for implementation are all considered together. A very small number of recommendations were judged as unacceptable. The data on the remainder places them in various stages of implementation. The "extensively implemented" recommendations and the first to be implemented may be those most easily carried out. The reasons and the completion dates accompanying the judgments "to some extent" and "to a very limited extent" reveal that those recommendations are in the process of being implemented. The judgments "nothing done" coupled with the reasons for not implementing them and the projective dates are evidence that in many schools this judgment should be interpreted as "nothing done to the present time," but considerable foundation work is being done and barring unforeseen difficulties many of these recommendations will be moved into the "implemented to some extent" and "extensively implemented" columns.

Educational practices that are affected by evaluations lie in the areas of instruction, curriculum revision and additions, and increased interest in many other professional activities related to education. Criticisms of evaluations and evaluative procedures seem to revolve around the preparations for and the understanding of the evaluation program. Other concerns are the short time the visiting committee spends in the school compared to the scope of the recommendations, and the qualifications of the committee members. Some of the school personnel feel that they need and could use more help in making use of the evaluation report.

Microfilm $2.00; Xerox $5.40. 106 pages.

IMPROVING THE PROGRAM OF CITIZENSHIP EDUCATION THROUGH THE SOCIAL STUDIES IN NEW SOUTH WALES SCHOOLS

(L. C. Card No. Mic 59-238)

Les McKenzie James Gordon, Ed.D.
Stanford University, 1958

The analysis of the history of education in New South Wales revealed that heavy stress has always been placed on factual acquisition. Citizenship education, on the other hand, with its emphasis on the development of attitudes and ideals, has traditionally been regarded as the function of the home and other public institutions, but not of the school. Even in the comparatively stable days prior to World War II, overseas visitors and some Australian educators warned that too little consideration was being given to citizenship education in New South Wales schools.

The end of World War II found curricula unchanged but New South Wales culture no longer stable. Dynamic forces, in the shape of vastly expanded industrialization, an immigration program of unparalleled magnitude, urbanization movements, and a changing family role, were already evident. The problem was one of introducing functional curricula, with the school assuming some responsibility in the development of attitudes and values, a field partly vacated by family and other societal institutions.

Consideration was next given in this study to the cultural changes evident in postwar New South Wales, and to their educational implications. Elementary and secondary curricula were examined and the scope for change was investigated. Some indications were found that the N. S. W. Department of Education, its inspectors, principals and teachers were endeavoring to develop more functional curricula, especially in the social studies. American programs of citizenship education which, in the writer's judgment, offered scope for trial in the New South Wales social studies curricula were investigated. Attitudes of N. S. W. teachers and pupils and their American counterparts concerning project and unit approaches characterizing citizenship education practices were also investigated and compared.

In the light of the above it was felt that much could be done to improve N. S. W. curricula. While American citizenship education literature and programs have, in the last generation, emphasized the need for a total school approach, it is held that such an approach in New South Wales should be introduced gradually, while that centered in the social studies could be undertaken more expeditiously.

Innovations recommended for the total school approach include:

1. The introduction of the comprehensive type high school.
2. The statewide introduction of coeducation.

3. More movement between one type of secondary course and another.

4. Closer consideration of articulation problems.

5. The introduction of a "home room" at all grades in the secondary school.

6. Encouragement of more use of initiative in curriculum adaptation at the local level.

7. Expansion of guidance and counseling services.

8. Development of improved school-community relations.

9. Implementation courses in group dynamics and in intercultural relations should be given in all Teachers' Colleges.

Recommendations for improving the citizenship education program through the social studies include:

1. Social studies should form a part of every secondary school child's course. At present it would appear that the amount of social studies taken is inversely proportional to the intellectual ability of the child.

2. A set of Australian ideals should be formulated.

3. A "Mission of Australia" concept, along the lines of the "Mission of America," should be developed.

4. The establishment, at the University of Sydney or New England, or the Teachers' Colleges, of an equivalent of the Citizenship Education Project.

5. The introduction of a modified Kansas Study, as a pilot experiment, for N. S. W. city and county pupils in representative areas.

6. The development of a Detroit Citizenship type study in, for example, Newcastle or Wollongong.

7. All student teachers should be given theoretical and practical training in developing the unit and project techniques.

To the sound academic foundation already established in New South Wales schools, the addition of an improved citizenship education program, along the lines suggested above, would, in the writer's opinion, provide a more balanced curriculum, enabling young Australians to play an active and constructive part in their rapidly changing society. Microfilm $5.10; Xerox $17.00. 400 pages.

AN EVALUATION OF COUNTY AUDIO-VISUAL SERVICES

(L. C. Card No. Mic 59-239)

De Forest Shaw Hamilton, Ed.D.
Stanford University, 1958

1. STATEMENT OF THE PROBLEM. Authorizations in 1941 permitted California County Superintendents of Schools to provide audio-visual services to school districts. Since 1946 the services have expanded greatly. No evaluation of the effectiveness of the services by teachers has been reported. Therefore, this study tested a questionnaire designed to appraise county audio-visual services, and evaluated the perceptions of teachers about the effectiveness of the service to them and their pupils.

2. PROCEDURE. County audio-visual service programs were reviewed and one was selected for intensive study. Responses were obtained from 169 teachers in 23 schools of 19 elementary districts which followed the county course of study, and were provided supervisory and consultant services.

An item analysis of responses was made to test the effectiveness of the questionnaire. Chi squares were used to test 14 "null" hypotheses.

3. FINDINGS. The county audio-visual service was perceived as being "always satisfactory" to 36.9 per cent, "usually satisfactory" to 54.8 per cent, "some satisfaction" to 6.5 per cent, "not satisfactory" to 1.2 per cent, and "no opinion" to .6 per cent; and was perceived as being "always helpful" to 37.9 per cent, "usually helpful" to 49.1 per cent, "some help" to 10.7 per cent, "no help"-zero, and "no opinion" to 2.4 per cent.

No significant differences in degree of help in selection and utilization of audio-visual materials was received from the audio-visual directors as compared to supervisors or consultants; both were significantly more helpful than workshops. Helpfulness of audio-visual catalogs over courses of study, teachers' guides, monographs and units was significant.

All types of audio-visual materials were more helpful in social studies and science than in health and safety, reading, art, language arts, arithmetic, physical education, and music, in that order, and significantly more materials were used in the same order.

The helpfulness of audio-visual materials to pupils was perceived as being significantly greater in increasing interest and attitudes than in improving achievement.

Motion pictures were rated significantly more helpful than filmstrips, recordings, study prints, slides and models and specimens, in that order.

Significantly more motion pictures than filmstrips, more filmstrips than recordings, more recordings than study prints, more study prints than models and specimens; and more models and specimens than slides were used.

Delivery and pick-up service was significantly more helpful than audio-visual catalogs and request forms.

Teachers expressed no significant difference of opinion regarding helpfulness or satisfaction with the county audio-visual services not did they use significantly greater amounts of materials because of grade level taught, class or school size, years of experience, degrees or credentials possessed, or completion of audio-visual education courses.

4. CONCLUSIONS. (1) The instrument tested was satisfactory and as revised should be used to evaluate other county audio-visual services; (2) County audio-visual services are "helpful" and "satisfactory" to elementary school teachers; (3) teachers have positive opinions that the majority of their pupils receive help from audio-visual materials in increasing interest and attitudes; (4) teachers favor and use more of all types of audio-visual materials in social studies and science, and believe that motion pictures are most helpful to the majority of the pupils in their classrooms, and use them more than any other type; (5) audio-visual catalogs are more helpful than courses of study and other curriculum guides for selection and utilization; (6) audio-visual directors are as helpful as supervisors or consultants; and (7) delivery and pick-up service is a helpful part of the county audio-visual service.

Microfilm $3.95; Xerox $13.40. 307 pages.

THE RELATIONSHIP BETWEEN CHILDREN'S DRAWINGS AND READING ACHIEVEMENT, PERSONAL-SOCIAL ADJUSTMENT, AND INTELLIGENCE

(L. C. Card No. Mic 58-1170)

Louis Adolph Kollmeyer, Ed.D.
University of Oregon, 1958

Adviser: Bert Y. Kersh

Statement of the Problem

It was the purpose of this study to test the general hypothesis that a child's reading achievement, personal-social adjustment, and intelligence will be reflected in his drawing development.

In drawing, the research was limited to judgments of children's developmental level, type of representation, color relationships, representation of the human figure, spatial concept, figure-environment size relationship, and motor control. Achievement in reading was measured by the Gates Primary Reading Test, Grade 1 and Grade 2 (first half), containing sections in word recognition, sentence reading, and paragraph reading. Personal-social adjustment was measured by the California Test of Personality, Primary Series, Form AA, containing components of self-reliance, sense of own worth, sense of personal freedom, feeling of belonging, degree of withdrawing tendencies and nervous symptoms, social standards, social skills, degree of anti-social tendencies, and family, school, and community relationships. The intelligence quotients were measured by the SRA Primary Mental Abilities test.

Procedure of the Study

The population used in the study was 112 first grade children, 60 girls and 52 boys, in attendance in five classrooms in the Eugene, Oregon Public Schools. The classrooms were chosen on the basis of the general competency of the cooperating teachers, who were selected upon the bases of their maintaining a democratic, permissive type classroom, and their success in working with first grade children. There was no attempt to control the population sample in socio-economic status or intelligence.

All data were gathered within a five week period during the eighth and ninth months of the school year. Five drawings were secured from each child. They were based upon personal experiences of the children, involving activities relating to their home, school, and community environments. Descriptive terms and characteristics of the drawings were based upon information found in the literature in art education and upon the opinions of recognized authorities in the understanding of children's art expression. The reading tests were given on a group basis by the classroom teachers, the personality tests were given by the writer on an individual basis, and the intelligence quotients were secured from the permanent school records.

The number and percentage of drawings containing each of the qualities under the drawing characteristics were determined for each class interval of a frequency distribution of paragraph and total reading levels, for each percentile group of selected components and the totals of the personality test, and for each class interval of a frequency distribution of intelligence quotients. By means of the chi-square test, the relationships between the drawing characteristics and the results of each of the tests were then statistically analyzed. The relationships were accepted as significant at the .05 level of confidence.

Conclusions

The analysis and interpretation of the data collected suggest the following conclusions:

1. Significant relationships at the .01 level were found between achievement in total reading and drawing with respect to all of the drawing characteristics identified in the study. Also, significant relationships at the .01 level were found between achievement in paragraph reading and drawing with respect to all of the drawing characteristics except type of representation.

2. The relationships between personal-social adjustment and drawing were found to be significant in the following specific relationships:

   a. total personal adjustment and drawing with respect to developmental level, use of color, figure-environment size relationship, and motor control at the .01 level, and all aspects of the human figure at the .05 level;

   b. total social adjustment and drawing with respect to developmental level, use of color, relationship of body parts in the human figure, figure environment size relationship, and motor control at the .01 level;

   c. total adjustment and drawing with respect to developmental level, use of color, relationship of body parts in the human figure, spatial concept, and motor control at the .01 level, and realistic and geometric qualities in the human figure, and figure-environment size relationship at the .05 level;

   d. freedom from withdrawing tendencies and drawing with respect to the use of color, and realistic and geometric quality in the human figure at the .01 level, and figure-environment size relationship at the .05 level.

   e. freedom from nervous symptoms and drawing with respect to use of color, both realistic and geometric quality and flexible and rigid schema in the human figure, spatial concept, and figure-environment size relationship at the .01 level, and developmental level and motor control at the .05 level;

   f. freedom from anti-social tendencies and drawing with respect to developmental level, use of color, both realistic and geometric quality and flexible and rigid schema in the human figure, spatial concept, figure-environment size relationship, and motor control at the .01 level.

The relationships between the remainder of the items under personal-social adjustment and the remainder of the specific drawing characteristics were not significant.

3. The relationships between intelligence and drawing were found to be significant at the .01 level with respect to all of the drawing characteristics except type of representation, which was significant at the .05 level.

4. The relationships between both drawing and reading achievement and drawing and intelligence were more evident than were those between drawing and personal-social adjustment. Microfilm $4.40; Xerox $14.80. 341 pages.

A STUDY OF THE ACADEMIC ACHIEVEMENT OF THREE CLASSES IN GRADES ONE TO SIX IN THE TOWNSHIP SCHOOLS OF CARROLL COUNTY

(L. C. Card No. Mic 58-3193)

Byron K. Rose, Ph.D.
Purdue University, 1958

Major Professor: Lee E. Isaacson

This study investigated the academic progress of 657 pupils who entered the first grade of one of Carroll County's fourteen elementary schools in 1948, 1949, and 1950. Each pupil was given a standardized achievement test at the end of each school year, the Metropolitan Achievement Test or the Stanford Achievement Test being the instrument used. Mean scores on the tests were reported in terms of grade equivalents. Pupils in grade one were given the Detroit Beginning First-Grade Intelligence Test, Revised, and the Otis Quick-Scoring Mental Ability Test was administered to all pupils in grade five.

To determine the degree of continuity in the academic progress of pupils through the elementary grades, the pupils in each of the three classes studied were divided into three groups. The criterion used in making this division was grade one achievement scores. From the total population a superior, an average, and a poor group were selected, with 25 per cent of the pupils in each class comprising each group. In a comparison of mean achievement scores of these groups of pupils at each grade level, it was found that approximately one half grade in achievement separated the superior group from the average group and the average group from the low group in grade one but that this difference increased in two of the classes to about one and one half grades by grade six.

As an additional measurement of the continuity in academic progress, pupils were redivided into superior, average, and low groups on the basis of grade six achievement. "T" tests of significance were made between mean scores of the groups divided according to grade one achievement and groups divided according to grade six achievement. At the five per cent level of confidence, no significance was found in the differences between means and it was assumed that the two methods of division produce groups that are essentially the same.

To determine the validity of the grade one achievement score as a predictor of subsequent academic progress, product-moment correlation coefficients were computed between grade one scores and scores at subsequent grade levels. The coefficients ranged from .845 to .574, indicating a high degree of validity in the score's predictive value.

Product-moment correlation coefficients were also computed between achievement scores at successive grade levels to determine if the validity of the achievement score as a predictor of subsequent academic progress increases at the higher grade levels. In two of the classes, the coefficients were .931 and .975 when scores in grades five and six were compared. The predictive value of the achievement score appeared to increase significantly at the higher grade levels.

To determine the relationship between achievement scores and intelligence quotients, results from these two types of tests were compared in grades one and five. Correlation coefficients ranged from .575 to .671 in grade one and from .689 to .801 in grade five. The correlations support the theory that achievement tests measure in part mental processes that are important indications of intellectual ability.

In an analysis of the effect that the age of the pupil has upon his initial and subsequent academic progress in school, product-moment correlation coefficients were computed between age and achievement in grades one and six. Resultant coefficients, ranging from .017 to .108, indicated that age at entry had virtually no effect on achievement.

A special study was made of 83 pupils in the sample who had been retained in the same grade for two years. This group showed an academic gain of .55 of a grade during the year repeated and a gain of 1.18 grades during the two years following retention. After their year of retention, they made an average annual gain in achievement of .67 of a grade per year. Approximately 25 per cent made good progress after retention, 29 per cent made fair progress, and 46 per cent made poor progress. When compared with a control group of 30 low-achieving pupils who were very similar in age, achievement, and intelligence, but who had never been retained, it was found that the academic progress of the retained group was not equal to the control group. The control group had an average annual gain in achievement of .83 of a grade while the gain of the retained group was only .67 of a grade. The mean achievement of the control group was four tenths of a grade superior to that of the retained group in grade six. It appeared that the extra years of instruction failed to solve the academic difficulties of the retained pupils.

An effort was made to compare the progress of pupils retained in grades one and two with that of pupils retained in the higher grades. However, about 80 per cent of the retentions occurred in the first two grades, leaving an insufficient number at the higher level of comparison. The findings indicated a great similarity in the progress of pupils retained in grades one and two and, on the basis of a limited sample, it appeared that this similarity existed through grade four.

Microfilm $2.00; Xerox $5.20. 101 pages.

A CRITICAL ANALYSIS OF CERTAIN ELEMENTS OF SUPERVISORY TRAINING PROGRAMS OF SELECTED CIVIL SERVICE AGENCIES AT THE REGIONAL LEVEL

(L. C. Card No. Mic 59-179)

Sylvester Larry Roush, Ph.D.
The University of Texas, 1958

Supervisor: James W. Reynolds

The nontechnical training of supervisory personnel was determined to be an endeavor which is of particular importance in the overall training activity of the Federal government. Certain circumstances have resulted in increased attention to training in the Federal agencies since 1955. Because of this impetus on training there has been a development of nontechnical training programs in the various agencies. This research project attempts to analyze these programs with the intention of providing information and recommendations which can be used to improve and otherwise contribute to these programs.

The following elements of training programs were included for study: (1) the determination of training needs; (2) the organization of the training administered to meet the discovered needs; and (3) the evaluation of the program. The training programs at the regional level of certain Federal agencies were selected for examination. They were: Post Office Department, Dallas Region; United States Treasury Department, Internal Revenue Service, Dallas Region; and United States Civil Services Commission, Eighth United States Civil Service Region.

The underlying principles of the training program elements were collected from the pertinent literature. A careful and detailed study was made to determine the identity and character of each element in the various programs. A series of trips to the regional sites was made during which time personal interviews were held with the involved agency personnel and examinations of the pertinent records were employed to collect the necessary information. An analysis was then made of each agency's accomplishments using the principles from the literature as criteria.

The analyses revealed certain strengths and weaknesses in each of the three training programs. These findings were used as a base for several broad conclusions. Briefly stated, these conclusions are:

1. There is considerable variation in the amount of emphasis placed on nontechnical training for supervisors among the three agencies examined
2. Certain activities were observed to be common to all of the agencies. The repetitive nature of these activities suggests a reexamination of the earlier decisions to restrict the centralized training activity of the Civil Service Commission
3. The use of training consultants from outside the ranks of the Civil Service was essentially nonexistent. In certain instances this appeared detrimental to the training effort of the agencies
4. The training environment of the programs examined did not include many of the stumbling blocks that are commonly found elsewhere. This circumstance should allow for much progress if these programs continue to develop
5. Action to correct the discrepancies which were revealed by this research should be undertaken immediately. The nature of this corrective action is indicated in the several analyses.

The need for certain additional research was evident as this research progressed. Recommendations for specific action included:

1. A close comparison should be made of the two divergent approaches to nontechnical supervisory training which were found to exist within the agencies with an attempt to determine the ultimate success of each
2. A study should be made of the instructor-training given to those chared with actual program administration
3. Intense investigations of advanced statistical design should be made to determine the objectivity, reliability, and validity of the various data collection devices used by the agencies.

Microfilm $2.85; Xerox $9.80. 220 pages.

EDUCATION, ADMINISTRATION

IDENTIFICATION AND DEFINITION OF THE CRITERIA RELEVANT TO THE SELECTION OF PUBLIC SCHOOL ADMINISTRATIVE PERSONNEL

(L. C. Card No. Mic 59-236)

Conrad Briner, Ed.D.
Stanford University, 1958

The Problem

This study is concerned with the identification and description of the criteria or bases for judgment used by superintendents of schools in selecting subordinate administrative personnel.

Two major objectives are realized in this study: one, the development of a guide depicting the kinds of information used in the selection of administrative personnel and the ways that information is secured and evaluated; and two, the development of content that is relevant to professional subject matter and suitable to the construction of attitudinal measurement devices. In general, the study provided a means whereby insight into apsects of basic attitude patterns of superintendents are obtained and related to administrator selection and training programs, performance upgrading, and general educational theory through an intellectualization or development of an understanding of the selection decision process.

The criteria reflected in this study are limited to the perceptions and verbal expressions of a selected population of elementary, secondary, and unified superintendents.

Methodology

The procedure used in this study involved the administration of a structured interview derived as a result of a preliminary classification of general statements identifying the selection criteria within two major areas: personal and professional attributes.

Quantitative interpretation of the data involved determining relationships of rank orders among and within groups of superintendents identified by age, length of service, type of district, and district social structure. The analysis, synthesis, and organization of the interview responses involved the extension and refinement of the original selection criteria.

Results

Review of the quantitative data revealed high levels of ranking agreement among and within the groups of superintendents.

Review of the substantive nature of the interview responses revealed three kinds of information within which the administrator appraised the qualifications of an administrative candidate: the physical and character image, levels of professional and personal potential, and levels of demonstrated professional and non-professional competence.

I. The physical and character image was viewed in terms of:

   A. Demographic Image
   B. Physical Image
   C. Social Context Image

II. Levels of professional and non-professional potential were appraised in terms of:

A. Quality of Language Skills and Verbal Intelligence
B. Quality of Definition of Educational Goals and Social Philosophy
C. Quality of Academic Training
D. Quality of Psychological Constitution and Cooperative Enterprise
E. Quality in Use of Rational Techniques

III. Levels of professional and non-professional competence were appraised in terms of:

A. Demonstrated Competence in Field Experiences
B. Demonstrated Competence in the Use of Special Knowledges
C. Demonstrated Competence: Recommendations
D. Demonstrated Competence in Professional Contributions

The definition of each category was extended to include examples of three types of interview responses characterizing each category: modal responses, range of responses, and confused responses.

Conclusions

1. The attitudes of public school superintendents that influence the selection of subordinate administrative personnal can be identified and described in behavioral terms.

2. No commonly defined and accepted procedure is used by public school superintendents to appraise the qualifications of administrative candidates.

3. Superintendents agree on an intellectual level which criteria are relevant to the selection process and how they rank in order of importance, but they disagree when defining the criteria at a personal level.

4. Attributes of administrative candidates are evaluated in terms of what generally can be construsued as a leader stereotype -- a group norm depicting the educated American man.

5. The influence of an outside agency or program in assisting the identification and selection of administrative personnel is subordinate to the super-ordinary attitudes (basic prejudices) expressed by the superintendent.

6. The ability of college and university courses and professors to influence the selection process appears significant. Microfilm $2.25; Xerox $10.00. 171 pages.

A STUDY OF THE RELATIVE EFFECTIVENESS OF ADMINISTRATIVE STAFFING ORGANIZATION IN FOUR CENTRAL SCHOOL DISTRICTS

(L. C. Card No. Mic 59-121)

William McGregor Deller, Ed.D.
Cornell University, 1958

The recent development of an administrative staff in central rural schools has been concurrent with the present expansion in the school population. The staffing organization has developed individually in each district. But the presence of available manpower has initiated the use of full-time and part-time administrative assistants. The present study examines these two types of help to the chief school administrator.

The purposes of this study were:

1. to compare the relative effectiveness of part-time and full-time administrative positions;
2. to measure the actuality of delegation of authority to subordinate administrators;
3. to compare the pattern of leadership within a faculty with the formal organization of authority;
4. to evaluate the relative usefulness of the detailed study of a single school as a method of approach to administrative problems.

Four schools were chosen for this study because of their size and administrative staffing. In each school a sociogram questionnaire and an opinion inventory was given to each teacher. Each of the administrators was interviewed by the author. The results of the opinion inventory were analyzed by an analysis of variance, multiple classification, to test three null hypotheses. The sociograms were compared with the reported delegation of authority.

The following conclusions are reported from this study:

1. the schools studied showed a high faculty morale, implying good administrative effectiveness in each;
2. full-time administrative positions show a significant difference in effectiveness favorably over part-time administrative positions when measured by faculty morale;
3. school size was not found to be a significant factor in measuring administrative effectiveness in this study;
4. the difference between the means of the scores of the four individual groups and the means of the total was found to be non significant;
5. delegation of pupil control is more fully accomplished in schools with full-time administrative assistants than in schools with part-time assistants;
6. as measured by sociogram response actual delegation of the function of pupil accounting does not correspond with the reported delegation;
7. curriculum planning is more a shared professional responsibility of the faculty than an administrative function as reported;
8. subject matter specialists are a primary source of information to other teachers, and the State Department of Education is not considered as a major source of help by teachers with problems;
9. parents are considered as an important source of help in solving the problems of learners;
10. unofficial delegation of a function occurs on some routine functions;
11. chief school administrators retain full control of purchasing function;
12. within the areas covered by the sociogram questionnaire those to whom authority had been granted were generally the chosen leaders, i.e., the formal and informal organization was the same;

13. in the schools studied, the chief school administrator and the subordinate evaluated the subordinate position in similar light, the subordinate mentioning more details;

14. the case study approach to a given school enables the individuality of the school situation to be seen in proper perspective.

Microfilm $2.00; Xerox $6.80. 144 pages.

CURRENT PRACTICES IN ADMINISTRATIVE STAFFING IN THE PUBLIC SCHOOLS OF NEW YORK STATE WITH EMPHASIS ON UNION FREE SCHOOL DISTRICTS

(L. C. Card No. Mic 58-5878)

Robert David Forrest, Ph.D.
Cornell University, 1958

Statement of the Problem

In recent years the job of school administration has become increasingly complex due to the development of the concept of the administrator as a civic leader, the increased size of school districts, a greatly expanded curriculum, and the extended use of the school as a service center for the community. As his duties and responsibilities have multiplied, the chief school administrator has found it necessary to expand his administrative staff and has delegated many of the administrative and supervisory functions to subordinate members of that staff. The size and organization of the staff, the manner in which it functions, its problems and its effective practices are aspects of the general problem of administrative staffing with which this study deals.

Purposes of the Study

The major objective was to determine the current situation in administrative staffing and thereby indicate the steps necessary to bring about an improved more effective administration. Specific purposes were:

1. To construct an inventory of administrative functions.
2. To determine the existing size and composition of administrative staffs.
3. To determine the size of the administrative staff desired by the chief school administrator and to use this as a measure of the adequacy of the existing staff.
4. To determine the significant patterns for delegating and sharing administrative functions by the chief school administrator.
5. To discover the administrative staffing problems of greatest concern to the chief administrator.
6. To discover those practices which the chief administrators believe to be particularly effective in promoting sound, efficient and harmonious administration.

Procedures and Outcomes

Questionnaires were sent to all public schools in the state. Data were analyzed for those schools having an average daily attendance under three thousand. Union free schools were treated as a separate group and in combination with central schools and city schools. Major outcomes of the study were:

1. An inventory of fifty-two administrative functions was developed.
2. A system of administrative categories was developed which permitted a quantitative measure of the administrative staff.
3. The existing size and composition of administrative staffs were related to the enrollment of the schools.
4. The size of administrative staffs desired by chief school administrators was compared with existing staffs.
5. Graphs were drawn showing the delegation patterns for each of the administrative functions.
6. The most effective administrative practices were summarized.

Findings and Conclusions

The factors relating to administrative staffing revealed no significant differences in the three types of school districts represented. The union free schools, central schools, and city schools had similar administrative practices.

School enrollment was the major factor influencing administrative practice. As the size of the school increased, so did the size of the administrative staff. The delegation patterns also changed, generally toward more delegation, as the schools increased in size.

Administrative staffs were universally undermanned. The smaller schools felt the greatest need for additional personnel. These inefficient districts need proportionately more administrators to operate effectively.

Problems of administrative staffing were common to all districts regardless of size or type. The greatest problems were insufficient administrative and clerical help and the need for up-to-date, written school policies.

Quality of personnel was indicated as being more important than the nature of the organization in successful school administration. Capable staff members were emphasized much more strongly than were particular positions or organizational patterns.

Patterns for delegating the administrative functions fell into five general groupings although these groups did not conform to any commonly recognized organization of administrative duties.

Democratic administration was given a strong endorsement. Administrative teamwork and administrative cabinets were cited as being major contributors to effective administration.

Microfilm $3.80; Xerox $12.80. 295 pages.

A STUDY OF THE ROLE OF SELECTED NORTH CAROLINA SCHOOL SUPERINTENDENTS IN SCHOOL-COMMUNITY RELATIONS

(L. C. Card No. Mic 59-47)

Benjamin Eagles Fountain, Jr., Ph.D.
The University of North Carolina, 1958

Supervisor: Guy B. Phillips

The purpose of this study was to identify the critical tasks, job activities and operational beliefs of North Carolina school superintendents in the administrative area of school-community relations and to discern pre-service

training needs in the area. This study was a part of the Project for the Improvement of School Administrators conducted by the School of Education of the University of North Carolina and partially sponsored by the W. K. Kellogg Foundation.

The primary source of data was interviews with twenty-eight North Carolina school superintendents. A structured interview schedule was used to guide the interviews. The interview schedule was based in part upon the Competency Pattern for school administrators developed by the participants in the Southern States Cooperative Program in Educational Administration.

The administration of many aspects of the North Carolina public school system is largely centralized on the state level of government. The North Carolina General Statutes appear to centralize the responsibility for promoting public support of public schools in the State Superintendent of Public Instruction. The statutes appear to provide few directives or guides for local administrators in the performance of school-community relations job activities at the local level of school administration.

The superintendents interviewed for this study identified nine broad tasks in school-community relations as critically important. The superintendents identified three broad tasks in school-community relations as average or higher in importance but not as critically important. The tasks found not to be critically important by North Carolina superintendents had been proposed as critically important by the participants in the Southern States Cooperative Program in Educational Administration.

The superintendents considered eighty of 104 job activities distributed among the tasks as critically important to the successful performance of the tasks. Twenty-three operational beliefs underlying the administrative area of school-community relations were generally accepted as sound by the superintendents. One operational belief was generally rejected by the superintendents.

The major conclusions drawn on the basis of the findings are presented as follows:

1. Centralization of the North Carolina public school system at the state level and the lack of guiding statutes pertaining to local school-community relations tend to discourage efforts of local school and lay leaders to promote stronger citizen support of the public schools at the local level.

2. Organized attacks on local public school systems in North Carolina constitute no problem at the present for local administrators.

3. Most local administrators do not use all the available techniques for interpreting the schools to the public probably because of insufficient training and lack of time and other resources.

4. One handicap of efforts to increase state and national support of public schools is insufficient active cooperation of local administrators with organized efforts to increase support of schools at those levels.

5. Pre-service training which includes many practical experiences is necessary to develop competency in performance of the administrative function of school-community relations.

6. North Carolina school superintendents generally accept as a fact that the quality of the public schools depends upon the level of understanding and support given the schools by the citizens of the respective communities.

7. The weaknesses in performance of the school-community relations functions are probably not due to the failure of the present pre-service training afforded in the area for many administrators have had little or no pre-service training in that area of responsibility.

The study also included certain implications and recommendations for the improvement of pre-school training of prospective school administrators in the administrative area of school-community relations.

Microfilm $2.40; Xerox $8.40. 182 pages.

THE ORIGIN AND ESTABLISHMENT OF A STATE BOARD OF EDUCATION IN OHIO. (VOLUMES I AND II)

(L. C. Card No. Mic 59-376)

Marius Peter Garofalo, Ph.D.
The Ohio State University, 1958

The purpose of this investigation was to reconstruct the story of the origin and establishment of a state board of education in Ohio. Volume I includes an account of pertinent events dealing with the idea of a state board of education from early Ohio history to the adoption of a constitutional amendment in 1953 providing for a twenty-three member elected board, the passage of legislation implementing the amendment in July, 1955, and the election of the members of the first board in November, 1955. Chapter II, following an introductory chapter, is devoted to a discussion of state school administration in general. Chapters III and IV recount in sequential fashion the ideas and activities over a century of numerous individuals, groups and organizations, both public and private, in Ohio, who participated in the struggle for a state board of education.

Volume II encompasses the events that began with the first meeting of the new board in January, 1956, and ended with the meeting of June, 1957, when the board had just selected its own executive secretary -- the state superintendent of public instruction. This second part is oriented toward a description of the organizational growth of the board and a narration of the steps it took as an agency of state government to carry out the responsibilities assigned to it by law. Chapter V includes a detailed account of the first organizational meeting, a compilation of the rules of procedure adopted by the board to govern its own actions, and the delineation of the events relating to the selection of a state superintendent of public instruction. Chapter VI contains a description of the position of the board in state public administration and the relationships it established with state governmental agencies, state school agencies, other state associations, national agencies, and the press in the state. In Chapter VII an account is given of the policies formulated by the board with respect to its responsibilities. Chapter VIII includes a discussion of the leadership activities of the board as a whole and of its members as individuals. An attempt is made in Chapter IX to speculate about future happenings in regard to the board in Ohio and to raise some questions about the popularly elected board as an agency for state school administration.

Data for the investigation were drawn almost entirely from primary sources within the state of Ohio: the acts

and resolutions of the General Assembly for nearly one hundred years, the messages of governors; reports of the commissioners of common schools and succeeding chief state school officers; minutes of the state board of education; reports and minutes of various educational, business and social organizations; sundry state documents, newspapers and periodicals; interviews; personal correspondence with members of the legislature; and personal observations at the twelve monthly meetings of the board in 1956. Microfilm $7.25; Xerox $25.20. 571 pages.

FLEXIBILITY IN SECONDARY SCHOOL BUILDINGS

(L. C. Card No. Mic 58-5206)

E. Eugene Higgins, Ed.D.
Indiana University, 1958

Chairman: Paul W. Seagers, Ed.D.

The study proposed to determine the educational reasons for and design characteristics of flexibility as related to the planning and construction of secondary school buildings. It sought to ascertain the thinking concerning such flexibility expressed by educators, school architects, personnel of state education agencies, school building planning conferences, and published codes, guides, manuals, or regulations of state education agencies.

A study of the literature, comprised of textbooks, educational annuals, proceedings of educational conventions, reports of school building planning institutes and conferences, professional periodicals of education, state codes, guides, manuals, regulations, or planning recommendations for secondary school buildings, and miscellaneous source materials, was made to extract opinions regarding flexibility in secondary school buildings. A particularly thorough investigation of the publications since World War II was made, so that the study basically covers an eleven-year period.

Data in the form of instances of reported thinking with respect to flexibility in secondary school buildings were classified and recorded in the following categories: writings of educators, writings of school architects, writings of state education department personnel, reports of conferences, and codes, guides, manuals, regulations, or suggested standards of state education agencies.

There were increases in writings and reports concerning flexibility in secondary school buildings for the last five years of the study interval over the first five. The accretion was 100 per cent for educators, 90 per cent for architects, 170 per cent for educators and architects associated with state education agencies, 60 per cent for conferences, and 185 per cent for codes, guides, manuals, regulations, or suggested standards of state education agencies.

While educational reasons given for flexibility in secondary school buildings overlapped, it was possible to classify them into seven basic categories. In order of frequency, reasons given were: capacity for curricular change, ability to reallocate space, economy, delaying of obsolescence, ability to alter size and shape of space, caring for population changes, and accommodation of changing teaching methodology.

Specific design characteristics of flexible secondary school buildings which were mentioned also overlapped, but it was possible to arrange them in ten basic categories. The top seven characteristics were: movable or removable partitions, non-load bearing partitions between classrooms, service systems arranged to permit relocating interior partitions, maximum runs of room space permitting alterations, movable prefabricated partitions, modular coordination of design elements, and exterior walls planned to permit relocating interior walls.

The major conclusions were: flexibility in secondary school buildings is a quality of planning and construction which provides capacity for curricular change, including adding to the curriculum, deleting from the curriculum, improving the educational program, meeting changing social needs, changing subject-matter sequence, changing the character of space, and avoiding fitting the educational program to the building; flexibility in secondary school buildings is a technique of planning and construction making possible the reallocation of space, including changes desired during the construction period, adapting to future needs, changing the arrangement of rooms, and preserving the architectural effect of the basic structure; flexibility in secondary school buildings is economical with respect to efficient use of the building, making changes at lowest cost, time-saving during alterations, and maintenance; and flexibility as a quality of planning and construction of secondary school buildings is receiving increasing recognition by educators, school architects, state education agency personnel, educational conventions, school building institutes, and policy publications of state education agencies. The major recommendations were: that movable or removable partitions be used in secondary school buildings; that non-load bearing partitions be used between classrooms in secondary school buildings; and that service systems for heating, ventilating, lighting, plumbing, and vacuum cleaning be arranged to permit relocating interior partitions in secondary school buildings.

Microfilm $2.80; Xerox $9.60. 214 pages.

A PROGRAM FOR EDUCATION ABOUT ALCOHOL IN THE PUBLIC SCHOOLS OF UTAH

(L. C. Card No. Mic 59-1084)

Knight Belnap Kerr, Ed.D.
University of Utah, 1959

Chairman: E. T. Demars

The problem. The problem of this study was to experiment with a suggested program of instruction about alcohol for the public schools of Utah. After an intensive study of the literature, suggestions for a proposed program were formulated. These suggestions were in the form of subject outlines for junior high school Health and senior high school Driver Education, Health or Biology, and Social Studies. They also included a list of basic items of information and a list of suggested activities.

Thirty teachers with three thousand eight hundred and seventy five students tried out these outlines and lists, giving their opinions regarding the instruction and making suggestions for its improvement. Suggestions were also

made by a number of experts in the field. These evaluations were the basis for recommendations for a coordinated program of instruction for the Utah public schools.

Findings. The following were the important findings of the study:

1. Although it was concluded that the instructional program was effective, there was an indication that many students were slow to accept some facts about alcohol.
2. Hearing the personal story of an alcoholic seemed to be important in changing student attitudes.
3. Teachers who presented the facts about alcohol and did not take a stand for or against drinking obtained a more enthusiastic response on the part of students generally than did those who took such a stand.
4. Teachers seemed quite well satisfied with the outlines and teaching helps which were provided.
5. Listed by the most teachers and students as successful, profitable, and best liked activities were: films, Alcoholics Anonymous speakers, class discussion, and field trips (Ninth through Twelfth Grades only took field trips).
6. Classroom libraries created a lot of interest and stimulated considerable research on the part of students.
7. Generally speaking, students seemed well satisfied with their program of instruction.
8. Teachers indicated that the subject should be taught in their own particular subject areas. Most students listed the grade and class in which they were enrolled at the time of the study as the most suitable place for instruction about alcohol.

Conclusions. The following conclusions were formulated, based upon the findings of the study:

1. Instruction about alcohol could be quite effective when carried out in fairly well defined places within the curriculum and with materials suitable to the age, interests, and experience of students.
2. The enthusiasm with which teachers received the subject matter outlines and teaching helps prepared for their use indicated a definite need for this type of help from the district and state levels.
3. Instruction could be given to good advantage in junior high school Health or Science.
4. Senior high school Driver Education, Social Studies, and Health appeared to be areas where effective instruction could be carried out.
5. Effective learning seemed to take place best when there was a good learning situation and when good teaching techniques were used.

Recommendations. The following recommendations are made:

1. That the State Department of Public Instruction make available to teachers suggested outlines and teaching helps.
2. That local school districts endeavor to coordinate instruction so as to avoid unnecessary duplication.
3. That local school districts encourage teachers to take special training in the area of education about alcohol.
4. That education about alcohol be carried out at the following grade levels and in the following subject matter areas, using the recommended outlines and materials: Eighth Grade Health or Science, Tenth Grade Driver Education, Tenth Grade Health or Biology, and Eleventh or Twelfth Grade American Problems or Sociology.
5. That there be continuing research as regards effective teaching techniques and class activities, effective teaching aids and materials, and where and when in the curriculum this subject might most advantageously be taught.

Microfilm $3.25; Xerox $11.00. 249 pages.

A FOLLOW-UP STUDY OF WOMEN GRADUATES FROM THE STATE COLLEGES IN MISSISSIPPI, CLASS OF 1956

(L. C. Card No. Mic 59-418)

Katharine Rea, Ph.D.
The Ohio State University, 1958

The purpose of the investigation was to study recent women graduates of the eight state colleges in Mississippi in regard to employment status in relation to point-hour average, salary, marital status, and type of work. Findings indicated that grade average is not an accurate predictor for annual earnings of graduates in either beginning or previous job experience. The median grade average for all employed was 1.5 to 2.0 based on a three-point grading system. Median salaries were $2,805 for single employed graduates and $2,233 for married employed graduates. Median salary for all employed was $2,469; for graduates in beginning jobs, $2,649; and for experienced job holders, $2,232.

The majority of the graduates were teachers. First-year teachers earned a median salary of $2,425 and experienced teachers a median salary of $2,217. Some of the graduates of usual college age were employed as home economists, secretaries, and professional workers in other fields, all earning salaries above $3,000.

Job satisfaction was high as evaluated by employed graduates. There was also widespread endorsement of the job usefulness of college training and of college counseling services. Conclusions about the relationship of extra-class and extra-job activities to point-hour average and salary were not decisive. There was evidence of little carry-over value for extra-class activities into extra-job participation.

The population for the study included 573 women graduates, 272 of whom were married, 237 single, 33 engaged, and 31 either widowed, divorced, or separated. Only graduates who had been granted baccalaureate degrees were participants in the study.

Negro women graduates made up 26 per cent of the population. Except for differences in salary, information supplied by both white and Negro respondents was fairly uniform. Employed Negro women earned a median salary of $2,085 and achieved a median grade-point average of 1.5 to 2.0. The majority of the Negroes selected teaching as a profession; the median salary for teachers was $2,085.

There is need for counselors to open up new avenues of occupational choices for college women. There is also a need to study how the average woman student can be helped to clarify her career objectives in long-range terms. Caution should be taken in using a college activity index as a criterion for job selection or as a measure of future extra-job participation. The status of the graduate who returns to college for a delayed degree suggests the need for future study.

Microfilm $3.05; Xerox $10.40. 234 pages.

THE EFFECTS OF EVALUATION UPON THE PROFESSIONAL GROWTH ACTIVITIES AND MORALE OF TEACHERS IN THE CINCINNATI PUBLIC SCHOOLS

(L. C. Card No. Mic 59-326)

George B. Redfern, Ed.D.
University of Cincinnati Teachers College, 1958

Purpose of the study.-- The purpose of the study was to determine the effect the Cincinnati teacher evaluation procedures have on the professional growth and morale of teachers. An analysis was made of the kinds of growth activities in which teachers participate, the extent to which evaluation motivates the participation, and the effect the process has on morale. A further, though less important, purpose was the determination of the effectiveness of the appraisal practices from an administrative point of view, i.e., to ascertain if teachers regard favorably or unfavorably the various aspects of the mechanical procedures of appraisal. An analysis was made also of the opinions of principals and supervisors regarding the effectiveness of teacher evaluation in the Cincinnati Public Schools.

Findings.-- Cincinnati teachers tend to select the type of growth activities in which participation is primarily on a group basis. Chief among these activities are: attendance at professional meetings and conferences, involvement in professional organization activities, participation in committee work within the individual school in which the teacher works, and identification with PTA and other school-community activities.

In terms of total participation, teachers less frequently choose growth activities in which involvement is on an individual basis. Typical of these are: child study, closer teacher-principal and teacher-supervisor contacts, different teaching techniques, educational research, graduate work, and visitation to other classes and schools.

From twelve to thirty-five percent of teachers give maximum motivational credit to evaluation for their participation in certain kinds of growth activities. Since there are many other kinds of incentives for teachers to become active in a wide range of activities, the influence which evaluation exerts should not be under-estimated. There is a tendency for evaluation to have a greater influence on secondary rather than elementary teachers for engaging in growth activities; "Needs Help" teachers (those in their probationary period) report that evaluation tends to provide more motivational influence than is the case with "Satisfactory" teachers (those in continuing contract status).

Evaluation appears to function best when it helps to identify areas of need for professional growth, thus alerting the teacher to that need. Through the advice and counsel of a competent and understanding appraiser or through the appraisee's own insight a plan for improvement is undertaken through participation in an appropriate growth activity. When this happens, evaluation is deemed to provide maximum motivation. Approximately twenty-five percent of the teachers indicate evaluation provides maximum motivation for engaging in growth activities.

The effect evaluation has on teacher morale can be generally summarized as follows: self-appraisal is not as stimulating or pleasant as other phases of the process; the conference with the supervisor is less stimulating; the help the principal and supervisor provide the teacher appears to be less conducive to good morale than the appraisal conferences. The steps the teacher takes for self-improvement are regarded as stongly morale-building.

Principals and supervisors tend to feel that evaluation promotes primarily better working relationships between the teacher and themselves. Other types of growth activities motivated by appraisal, as they see it, are: different teaching techniques, in-school committee work, workshop activities, and involvement in professional meetings and conferences. Slight motivation is provided for participation in group-type activities.

Appraisers generally believe that all steps of the appraisal process are stimulating and/or pleasant, ranking teacher-principal relationships as most morale-building. Teacher-supervisor contacts and self-appraisal follow in that order of importance. Appraisers tend to agree with teachers about the effectiveness of the Cincinnati appraisal procedures. Microfilm $4.70; Xerox $15.60. 365 pages.

THE STATUS AND BUDGETARY APPROVAL FUNCTION OF COUNTY COMMISSIONERS IN NORTH CAROLINA

(L. C. Card No. Mic 59-60)

William H. Wagoner, Ph.D.
The University of North Carolina, 1958

Supervisor: Guy B. Phillips

Public education is considered to be one of the foremost responsibilities and objectives of state and local government in America, and with the rapidly spiralling increase in pupil enrollments and continuing demands by the public for horizontal and vertical expansions of school programs the problems of findings adequate fiscal support have become acute. In North Carolina where local boards of education have no power to tax and must depend on the one hundred county governing bodies for budget review this problem of financing public education on the local level is further complicated. These school boards are vested with the responsibility of providing educational opportunities for the children under their jurisdiction but lack the authority to do more than request that some other governmental agency provide the means to make possible the fulfillment of this responsibility. Since county commissioners are the only tax levying authorities to which the large majority of these boards of education may turn for the provision of local tax funds and since with a few minor exceptions all school budgets in North Carolina must be approved by the one hundred boards of county commissioners, it was the purpose of this study to (1) determine the social and organizational status of the one hundred boards of county commissioners in North Carolina; and (2) analyze the budgetary approval function of the boards of county commissioners.

Much of the information for this study was collected from the files of the Institute of Government of the University of North Carolina. Such information consisted primarily of the organizational status of the one hundred boards of county commissioners. Data for that portion of the study dealing with the social status of individual county commissioners came from a questionnaire which was distributed by mail to some county official having close contact with and knowing well the individual commissioners on his respective county board.

The conclusions which seem warranted by a careful analysis of the findings of this study are:

1. Although all boards of commissioners are elected, the details of election and nomination vary from county to county.
2. No relationship exists between the size of the county, in population or in area, with the number of members on each board of commissioners or with the way in which they are nominated and elected.
3. All of the members of the present boards of commissioners are men and the precedent seems rather firmly set that women do not usually serve in this capacity.
4. There is a constant change in the legislation pertaining to the size, method of election, and compensation of county commissioners by each session of the General Assembly.
5. The problems of county government are becoming more complex as is evidenced by the frequent use of extra sessions of boards of county commissioners.
6. There is a trend in the direction of increased membership on the boards of county commissioners.
7. County officials other than the members of the boards of commissioners enjoy an unusually long tenure of office.
8. The budget approval function of the county commissioners consumes much of the time spent by these public officials in carrying out county duties.

Microfilm $2.05; Xerox $7.20. 155 pages.

A SITUATIONAL ANALYSIS OF THE TEACHER-PRINCIPAL RELATIONSHIP

(L. C. Card No. Mic 59-246)

Keith V. Waite, Ed.D.
Stanford University, 1958

This leadership study, one of a series conducted in conjunction with the Stanford Consultation Service, makes a comparative analysis of the teacher-principal relationship in two similar schools in one community.

Procedure

The data for the study were drawn from teacher interviews, standardized questionnaires, and critical observations over a five month period during which the researcher acted as a participant-observer with a field team -- including an Educator, an Anthropologist, and a Psychiatrist -- conducting as in-service training project with the two principals.

The investigation presents a comprehensive analysis of the personal characteristics of the principals, including their self-evaluation, and their prognosis of the reactions of the respective staffs to their leadership; explans in detail the history and development of the two schools, the changing makeup of their student bodies, and the characteristics and behaviors of their past leaders as remembered by the teachers; and examines closely the composition of the staffs at each school. The perceptions of the staffs concerning the behavior of their principals are measured, and relationships between the various situational factors and the measured perceptions are determined.

General Conclusions

The following general conclusions are drawn from the study:

1. Latent conflict, which is inherent in the teacher-principal relationship, is easily aroused into hostilities which can severely hamper the effectiveness of a school principal and seriously affect the efficiency of his staff members.
2. Group loyalty is not automatically accorded to the official leader, but must be earned before he can effectively operate in a leadership capacity.
3. In winning the support of a school staff a principal must conform to behaviors which are regarded by the staff as proper for his role. His effectiveness as a leader will be greatly affected by the success with which he is able to comprehend the nature of these expectations and behave in accordance with them. These expected behaviors can be grouped into three distinct, though not mutually exclusive categories which are:
    1. general expectations which evolve from the traditions and values of the teaching profession.
    2. institutional expectations which originate in the cultural setting of the local school.
    3. individual expectations of the staff members which vary with the personality characteristics of the individual teacher.
4. Despite the expectations held in common by teachers in general and by members of a particular school staff, the individualistic nature of each teacher's perceptions of his principal makes each teacher-principal relationship unique.

Implications for the training and selection of educational leaders

The study shows the importance of the processes of leadership to the effectiveness of a school principal. Leadership training should include instruction in this area, including procedures for potential principals to predict role norms or expected behaviors teachers may have for their leaders.

An awareness of the situational factors in a particular school -- the characteristics of the staff, the history and development of the school, and the resulting influence on the teachers' expectations for thier principal -- should be given careful consideration by those faced with the responsibility of selecting a principal who will operate effectively as a leader in that school.

Microfilm $3.80; Xerox $9.60. 214 pages.

EDUCATION, HISTORY

THE ROLE OF THE PRINCIPALS' ASSOCIATION IN THE DEVELOPMENT OF PUBLIC SECONDARY EDUCATION IN OREGON

(L. C. Card No. Mic 59-651)

Howard Blom Holt, Ed.D.
University of Oregon, 1959

Adviser: A. C. Hearn

The Problem

The purpose of this study is to determine the role of the Oregon Association of Secondary School Principals in the development of secondary education in Oregon.

Method of Investigation and Research Procedures

Data used in this study were gathered by three methods: (1) by examination of documentary evidence, (2) by analysis of returns from a questionnaire sent to members of the principals' organizations, and (3) by interviews with those who have occupied key positions during the Association's history. The resulting data were discussed in terms of: (1) the origin and main streams of development of secondary education in Oregon; (2) the origin and development of the Principals' Association; (3) the methods of operation employed in the functioning of the Association; and (4) the status of the Association in its environment.

Origin and Development of Secondary Education in Oregon

By 1929, when the secondary principals' organization was founded, the character of secondary education in Oregon had been well established. Secondary schools were attended by most high school age youth; secondary school organization as it exists in 1958 was already established; and the curriculum had been broadened beyond the traditional high school subjects. Between 1929 and 1958, secondary schools in Oregon have changed largely by expanding upon practices already in existence at the beginning of this period.

Origin and Development of the Principals' Association

The Oregon Association of Secondary School Principals was founded in 1929 to study secondary school problems and make recommendations for their solution. Through its history, the organization has continued to serve this purpose and has operated largely through the use of study committees that report to the annual meetings. The Association has considered a wide range of those problems which secondary principals face but has not dealt at all with certain important problem areas.

The Principals' Association as a Functioning Group

Six problem areas of recurring interest to the Association were studied in detail to reveal (1) the nature of the problem, (2) the Association's action, and (3) the results of that action. It was found that the Association often failed to study problems in a consistent manner, and that there was little evidence of long-range planning. There was evidence of changes in practices as the result of Association activity, however.

An analysis of replies to a questionnaire sent to Association members revealed general satisfaction with the organization's practices. Respondents ranked the Association's contributions to secondary education high on a scale as compared to other educational organizations of which they were members but did not list many specific contributions of the Association. Members indicated that there were certain values of such an organization which could not be explained in terms of its influence on secondary education.

Status of the Principals' Association

The data did not indicate that activities of the Principals' Association resulted in revolutionary change in secondary education in Oregon. Five hypotheses were suggested to explain this lack of effectiveness. The Association did have a part in the expanding, improving, and refining of educational practices already in existence. The Association had a close relationship with the Oregon State Department of Education and through this means influenced the kinds of standards that secondary schools in Oregon must meet. There is evidence that the Association serves as a forum, and as a means of communication among principals and constitute the most impelling reasons for the existence of such organizations.

Microfilm $3.40; Xerox $11.60. 261 pages.

EDUCATION, PHYSICAL

ATTITUDES OF MALE STUDENTS TOWARD PHYSICAL EDUCATION IN SELECTED JUNIOR COLLEGES OF CALIFORNIA, 1958

(L. C. Card No. Mic 59-237)

Russell Kelsey Cutler, Ed.D.
Stanford University, 1958

The Problem

The purposes of the study were: (1) To determine the general attitude of entering male students toward physical education in selected junior colleges of California; (2) to determine the attitudes of the respondents after one semester at the junior college level; (3) to evaluate the attitudes of the respondents in terms of implications for curriculum planning.

Research Design

The Scale

The five categories of a Physical Education Attitude Scale were assigned numerical weightings on a 5 point basis as in the Likert method. The Scale was arranged in four divisions: general information, including a graphic Self-Rating Scale; general attitude toward physical education; attitude toward required physical education; and attitude toward grading and credit for physical education. Positive and negative statements were equally divided.

Selection of the Sample

A random sample of 648 entering male students from 7 randomly selected California junior colleges was used.

The Attitude Scale was administered (Initial Survey) in September, 1957. The original respondents were retested (Final Survey) in January, 1958.

Reliability

Reliability of the measuring instrument was established by: (1) a pilot study, involving two groups of students from two universities, wherein the resulting test-retest correlations were .880 (N = σ_r = .040) and .790 (N = 86, σ_r = .036) - both correlations were significant at the .01 level; (2) employment of the criterion of internal consistency to determine the order of excellence for each statement - thus providing a scientific basis for the selection of differentiating scale items; (3) determining the relationship between Attitude Scale scores and Self-Rating Scale scores, involving two groups of students from two junior colleges, wherein the correlations were .420 (N = 107, σ_r = .078) and .435 (N = 73, o_r = .114) - both correlations were significant at the .01 level.

Validity

Efforts were made to obtain a valid instrument by: (1) logical "face" validity by preparing statements which were intended to tap generally accepted attitudes toward physical education; (2) review of the instrument by competent authorities; (3) pilot study (test-retest method); (4) statistical treatment of data pertaining to previous athletic experiences of the respondents which indicated that participation experiences tended to reflect favorable attitudes toward physical education.

Summary of Findings

1. All Initian and Final intra-institutional, combined institutional, and total score means with respect to attitude toward physical education were markedly higher on the favorability continuum than the respective neutral or undecided scores.
2. The response percentages by Scale categories for total scores indicated that approximately 75 per cent of the respondents were favorable toward physical education, whereas only 12-15 per cent were unfavorable (percentage differences significant at the .01 level).
3. Statistical interpretation of the intra-institutional Initial-Final mean differences with respect to general attitude and attitude toward required physical education disclosed that the differences were not significant. The "t" values for 6 of the 7 participating institutions ranged from .04 to 1.28, none of which were significant at the .05 level. Comparable results were noted with respect to attitude toward grading. One institution in each Scale division exhibited a mean difference that was significant at the .05 or .01 level.
4. The majority of the Initial-Final mean differences with respect to total scores were not significant at the .05 level. The critical ratios for 6 institutions ranged from .12 to 1.11. Institution B presented a "t" value of 2.28, significant at the .05 level.
5. A vast majority of the inter-institutional mean differences with respect to attitude toward physical education were not significant at the .05 level.
6. Institutional size, geographical location, and excellence of facilities had no significant relationship to attitudes.
7. All intra-institutional correlations between the various Scale divisions and between each of the Scale divisions and total scores were significant at the .01 level for 6 of the 7 institutions. The correlation coefficients ranged from .360, SE = .080, to .697, SE = .059.
8. The responses to the specific statement (number 26) that "students should be allowed to substitute other courses in the curriculum for physical education" were: 48.2 per cent in disagreement; 27.7 per cent in agreement; and 24.1 per cent undecided. The agree-disagree percentage difference (D) was 20.5 per cent (in favor of non-substitution); the standard error of the difference (SE) was 4.30; the "t" value was 4.77, significant at the .01 level.

Major Conclusions

1. The attitudes of first semester junior college males toward physical education in general, toward compulsory participation in the program, and toward the practice of awarding grades and credit for physical education were substantially favorable. These findings warrant curricular consideration.
2. The non-significance of the vast majority of the intra-institutional Initial-Final mean differences indicated that student attitudes had not changed appreciably as a result of junior college participation; attitudes were still consistently favorable.
3. The attitudes of the respondents were consistently favorable toward all aspects of physical education regardless of institutional size, location, or excellence of facilities. This implied that effective curriculum planning seemed more important than physical plant considerations.
4. Significantly positive intra-institutional correlations indicated that attitude toward the general physical education program, toward compulsory participation, and toward grading and credit were comparably favorable.
5. The strong student opposition to substitutions for physical education implied that certain administrative practices, relative to the provision of free substitution of electives for the traditional physical education requirements on the basis of an hypothesis that students favor such substitutions, were not scientifically justified.
6. Since accepted random sampling procedures were employed, it may be stated that the results of this California junior college attitude study may be given a state-wide interpretation.

Microfilm $3.55; Xerox $12.00. 274 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

EDUCATION, PSYCHOLOGY

THE ACHIEVEMENT IN MATHEMATICS AND SCIENCE OF STUDENTS IN THE NEGRO SCHOOLS AND COLLEGES IN MISSISSIPPI

(L. C. Card No. Mic 58-7902)

Tommie Marie Anderson, Ph.D.
Indiana University, 1958

Chairman: Merrill T. Eaton

Statement of the Problem

The problem in this study was to determine the incidence of talent for science and mathematics among Negro subjects enrolled in the schools and colleges in Mississippi. The sample included 1676 ninth grade, twelfth grade, and college freshman boys and girls enrolled in 26 high schools and four colleges in Mississippi.

Methods and Procedures

The data included in this investigation are test scores on the School and College Ability Tests; the Cooperative Science Tests; the Cooperative Mathematics Tests; and the Kuder Preference Record. The tests were administered and scored by the investigator.

The levels of performance on the intelligence and achievement tests were determined for the boys and girls at each grade level and have been compared with normative data. These normative data were the national test norms on the intelligence, mathematics, and science tests for ninth, twelfth, and freshman college subjects. The various parts of the achievement and intelligence tests were analyzed in order to determine the strengths and weaknesses of those subjects tested. Those subjects who were considered as talented in science and mathematics, that is, they scored at or above the 80th percentile on the science and mathematics tests according to national test norms, were then picked out and their individual performance shown. The Kuder Preference Record was then employed to determine if those subjects who were talented in mathematics and science also had interests in the areas that called for that facility, and to present the pattern of interests of all subjects who took the interest inventory. Relationships were established using the intelligence, achievement, and interest tests scores.

Findings

Based upon the hypothesis that the sample was representative of ninth grade, twelfth grade, and college freshman subjects enrolled in the public high schools and colleges in Mississippi, the following summary is made from the analysis of data:

Ninth grade, twelfth grade, and freshman college boys and girls in the public high schools and colleges in Mississippi do not perform as well as the norm groups for the Cooperative Mathematics and Science Tests and the School and College Ability Test. There seems to be little relationship between measured ability and measured interests of the boys and girls tested in this study. The measured interests seem to be more idealistic than opportunities and measured ability indicate. Too few subjects seem interested in jobs that require mechanical interests, and too many seem interested in jobs that require facilities that would be difficult for these subjects to master, in light of their measured ability.

Of the 420 ninth grade boys and 528 ninth grade girls, there are five boys, 1.15 per cent, and three girls, .57 per cent, who are considered as talented in science; and two boys, .48 per cent, and no girls who are considered as talented in mathematics. There were no twelfth grade boys and one twelfth grade girl, .36 per cent, who were talented in science; and no twelfth grade boys and girls talented in mathematics. There were two freshman boys, 2.1 per cent, and no freshman girls who were talented in science; and two freshman boys, 2.1 per cent, and no freshman girls considered as talented in mathematics.

The potential source of scientists and engineers among Negro subjects enrolled in the public high schools and colleges in Mississippi then, under existing conditions, is not great. Microfilm $2.15; Xerox $7.60. 164 pages.

A CONCEPTUAL FRAMEWORK FOR GUIDANCE

(L. C. Card No. Mic 59-360)

Atlee Beechy, Ph.D.
The Ohio State University, 1958

The primary purpose of this study has been to discover the basic psychological and philosophical concepts underlying guidance and to formulate these into a conceptual framework.

The need for a study of the philosophical basis of guidance is indicated by the scarcity of literature on this aspect of guidance and by the divergent and often conflicting views concerning the central concepts of guidance. Industrial changes, the demands for an efficient utilization of manpower, the world-wide ideological struggle for the minds of men, and the discussions regarding the role of the school in contemporary life have made further analysis and clarification of the role of guidance imperative.

The procedures used in the study include (1) an analysis of the psychic condition of modern man; (2) a review of significant social and economic changes in American culture; (3) a summary of the underlying concepts in vocational guidance, mental hygiene, and child growth and development movements; (4) a brief analysis of the status of guidance in American education; (5) a projection of foundational ideas underlying guidance; and (6) a formulation of a conceptual framework for guidance.

The study reveals that the psychological condition of modern man is not satisfactory. Man is constantly searching to find meaning and fulfillment. Essentially this involves the psychological process of becoming a person. The becoming process requires the perceiving and the occupying of physical, psychological, vocational, and aspirational space. The meeting of these life-space needs is necessary for productive and creative living for all men. The home and community agencies contribute toward meeting these needs. Education and guidance, however, have general and unique roles in helping students to meet their life-space needs.

Out of the analysis of the three educational and psychological movements, the evaluation of man's psychic

condition, and a review of social and economic changes emerged a cluster of basic philosophical and psychological concepts. These concepts emphasized the importance and worth of the individual, the dynamic nature of personality, the significance of individual differences, the crucial role of understanding and acceptance of self and others, and the wholistic nature of the individual. These concepts are not the exclusive property of any single discipline or movement.

Further study and refinement led to the formulation of a conceptual framework including five basic ideas. These are adjustment, individualization, socialization, vocation, and love. In one sense these five concepts may be viewed as psychological processes and/or stages through which the individual becomes--that is, perceives and moves toward fulfilling his life-space needs. These concepts also provide a framework through which human behavior may be viewed and understood. As such they have relevancy for the educator and the guidance worker. The framework is not only oriented toward understanding causative factors in human behavior but represents an attempt to philosophically orient guidance personnel to their larger responsibility of understanding the factors leading to maximum fulfillment in the life of the individual.

As the person moves toward occupying needed space the five concepts constantly interact with each other; each influencing every other concept and each in turn being influenced by the other concepts. Taken compositely they represent the structure and content of a conceptual framework for guidance.

The data of the study are confirmed by (1) the emergent pattern of life-space needs as revealed by a study of man's psychic condition, (2) the philosophical themes running through the cultural history of man, (3) the findings arising out of certain disciplines and organized attempts to help man meet his needs, and (4) the searching, sorting, and affirming evolving from the writer's reflection and confrontation with life.

Microfilm $5.80; Xerox $20.40. 456 pages.

THE SIGNIFICANCE OF SELECTED VARIABLES ON THE PREVALENCE OF SUSPECTED MENTAL RETARDATES IN THE PUBLIC SCHOOLS OF INDIANA

(L. C. Card No. Mic 58-7906)

Gene William Brockopp, Ph.D.
Indiana University, 1958

The purpose of this investigation was to determine the number of suspected mental retardates enrolled in the public schools of Indiana and to study the effect of selected variables on the prevalence. The variables selected were: location (rural and urban), availability of trained psychological personnel, and availability of special classes for the mentally retarded.

A survey questionnaire was sent to all public schools in Indiana requesting the appropriate school personnel to report on the basis of chronological age the number of children suspected of being mentally retarded. For the purpose of this investigation the psychological criterion of manifest intelligence as indicated by intelligence test scores (or by other more limited measures) was selected using 80 I.Q. as the approximate upper limit. Forms were compiled on 669,390 children or 80.42% of the total public school population in Indiana. 30.423 pupils in Indiana or 45.3 children per 1,000 were reported as suspected mental retardates. The total reported prevalence rose rapidly from 2 per 1,000 at age 6 to a maximum of 4.9 per 1,000 at age 14, after which it decreased sharply to .3 per 1,000 at age 19. In the total age group 10 more males than females were reported per 1,000 population. 7,525 children or 11.2 per 1,000 were reported as having an I.Q. below 70. The number reported in this classification increased gradually with age to a maximum of 1.4 per 1,000 at age 14. Urban school systems reported approximately 16 more children per 1,000 as suspected mental retardates than did the rural schools. In the urban schools the maximum prevalence appeared at age 13 with 5.8 per 1,000 reported whereas in the rural schools it appeared at age 14 with 4.2 reported per 1,000.

The special classes in the urban schools reported 16 more children per 1,000 than urban schools without special classes. In rural schools approximately six more children per 1,000 were reported from schools without special classes than from schools with special classes. When the urban school had both special classes and a psychologically trained person 29 more children per 1,000 were reported as suspected mental retardates than when the urban schools had only a special class. The above differences were all statistically significant.

School systems employing psychologically trained persons were slightly more variable in the percent reported as suspected mental retardates than were school systems without such individuals. The difference, however, was not statistically significant.

More children per 1,000 were reported as suspected mental retardates in urban than in rural schools. The data, however, indicated that this may be a result of the special services offered to the child of low I.Q. for in urban schools the percent of children reported as suspected mental retardates was directly related to the number of facilities which the school had for the mentally retarded child.

The psychologically trained person seemed to be the most important single determinant in locating the suspected mental retardate. It also appeared that school systems which had special classes and psychological services tended to meet the needs of the child of low I.Q. much better than other school systems. This was concluded from the fact that more suspected mentally retarded children were recognized in these schools, were recognized at earlier ages, and were attending school longer than in systems not offering these services.

In general, the data indicated that because of the variations in the population, prevalence rates cannot be transposed accurately from one school to another.

Microfilm $2.40; Xerox $8.40. 183 pages.

AN INVESTIGATION OF CERTAIN STATISTICAL METHODS FOR DETECTION OF NON-STANDARD TEST ADMINISTRATION

(L. C. Card No. Mic 59-149)

Leland Dixon Brokaw, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Benjamin Fruchter

This paper reports the adaptation of a non-parametric method and the application of two other techniques to the problem of detection of fallacious values in test score distributions. Fallacious scores may appear from several sources, including cheating, improper procedures of test administration, or errors of scoring. Detection of such scores in the results submitted by individual testing units as participants in nation-wide testing programs has provided a challenge beyond the scope of well-known statistical methods or information available prior to the current study.

The three techniques used were chosen because each of them is peculiarly appropriate to the task of detection of abnormalities of score distributions characterized by the shifting of a group of scores from its proper place within the distribution. One of the techniques, the sign test, a non-parametric, or distribution-free procedure, was devised for use in agricultural and biological experimentation. It functions through comparison of derived frequencies of positive and negative signs, determined as functions of the relative magnitude of pairs of measurements. The purpose of the technique is comparison of the effects of different treatments upon pairs of specimens. As presented in the literature the sign test is outlined for use in situations where the probability of appearance of a given sign is .5. In the current study it was necessary to modify the technique by deriving tables for use with different levels of probability. These different levels of probability are a function of the differential effects of regression in various portions of a retest score distribution, as compared with the distribution of original test scores.

One of the other two procedures, also a non-parametric technique, was the Kolmogorov-Smirnov test applied to the differences between cumulative proportional test and retest score distributions. This method is particularly sensitive to the appearance of spikes on a distribution. The peaking of scores at passing levels has been the crude index by which non-standard test administration has been detected in the past.

It is apparent that changing the position of a group of scores from their proper location will affect the variance of the score distribution. It is hypothesized that changes in variance between test and retest administrations of an instrument of high reliability should not reach significant levels, but that the changes introduced through artificial shifting of scores in one of the distributions might produce a significant difference. The t-test for the significance of the difference between correlated standard deviations was chosen as an appropriate device for this use.

The three techniques were applied to results based upon each of eight 100-case samples of basic airmen who had been tested and retested at Lackland Air Force Base on alternate forms of the Armed Forces Qualification Test. A control sample was selected and test scores from the other seven samples were altered to replicate conditions encountered operationally.

The sign test proved to be more sensitive and efficient than the other two techniques, identifying, beyond the 5 per cent level of significance, six of the seven samples containing fallacious data. The other two techniques identified four of the seven at that level of significance, although they did not identify the same four samples.

The possible value of the sign test to psychometric problems is recognized, and its application to other measurement problems is suggested.

Microfilm $2.00; Xerox $4.00. 73 pages.

THE CONCEPTS OF INTEREST AND NEED HELD BY TWO OCCUPATIONAL GROUPS

(L. C. Card No. Mic 59-151)

Deore J. Cannon, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Royal B. Embree, Jr.

Previous research has supplied evidence of certain relationships between two aspects of behavior: interest and personality. Theorists have contended that the need structure plays a dominant role in the development of interests and in occupational choice. One theorist has hypothesized that responses to interest measures are expressions of the individual's concept of himself in terms of occupational stereotypes. The relationship of needs and interests suggested the possibility of a need concept operating in occupational choice as well as the interest concept.

The purpose of this investigation was to study the concepts which individuals in Business Administration and in Engineering hold of their interests and needs; to study the concepts which they hold of the interests and needs of others and to discover the possible relationship between these concepts and occupational choice.

The Business Administration subjects were divided into three groups of twenty-five each. The Base group consisted of students in their final baccalaureate semester who had continued in their major since initial enrollment. The Consistent group consisted of academically classified Junior students who had persisted in their curricula since initial enrollment. The Inconsistent group consisted of Junior students now enrolled in Business Administration curricula but who had enrolled initially in an Engineering major. The Engineering students were divided into two groups -- Base and Consistent. The composition of these groups was the same as that for the Business Administration subjects.

The Kuder Preference Record and the Personal Preference Schedule were given to each group. The Base groups took the measures under standard instructions only. The Consistent and Inconsistent subjects were given the inventories a second time with instructions to project responses of an occupational model. One week later, the measures were given to those in the Inconsistent group with instructions to project responses of an Engineering model.

The instructions were defined to elicit concepts held by the subjects. The results of the first administration were defined as a self-descriptive concept. Results of succeeding administrations were defined as concepts held of others in a present or former occupation.

Nineteen hypotheses were presented for investigation. Analysis of variance was the basic statistic used in the treatment of the data. Other statistics were used when necessary. The following represent some of the findings of the study:

Between-group comparisons indicated that the groups held significantly different concepts of their own interests. Within-group comparisons indicated that members of each sub-group held concepts of their interests consistent with the occupational group concept. In the projections, the Business Administration groups tended to overemphasize areas related to Business Administration and to depress interests in some other activities. The Engineering group projected a concept of the interests of others similar to the concept which members of the Base group hold of their own interests.

Between-group comparisons involving the PPS produced no significant differences. The concept of the needs of others held by the Business Administration groups were significantly different from their own self-scores and the self-scores of the Base group. The concept of the needs of others held by Engineers and former Engineers was significantly different from their own self-scores and the self-scores of the Base group.

The results suggest that concepts of interest of others and self-concepts of interest might influence occupational choice. The results also suggest that individuals hold a concept of their own needs and the needs of others, but the present study did not find a relationship between these concepts and actual occupational choice.

Microfilm $2.15; Xerox $7.60. 162 pages.

IDENTIFICATION OF YOUTH PROBLEMS IN COSTA RICA

(L. C. Card No. Mic 58-3579)

Margarita Dobles, Ed.D.
Stanford University, 1958

Rapidly increasing national and school populations in Costa Rica and a high rate of drop outs raise questions concerning the adequacy of the educational program. Intelligent school planning requires data on student characteristics and perceived problems. Guidance specialists agree that this knowledge is obtained either by adults' or youth's perceptions of facts. However, since little research is available in the country regarding the youth's frame of reference, a self-appraisal method was selected.

The Methods. A check list was used for this cross sectional study. A first pool of items was developed from several sources. It was refined by Costa Rican adults with personal and professional experiences with adolescents and later by a sampling of youth. Following their suggestions, a final form was issued, with 330 items comprising eleven problem areas.

Pearson's product moment coefficient formula yielded a mean correlation of .87 in two test-retest analyses.

The sample included urban, rural and semi-rural areas, third and fifth (last) year at secondary school levels and both sexes. The students were chosen at random among those categories.

McNemar's formula for finding the standard deviation of a hypothetical distribution of differences was applied between the independent percentages of problems in each category.

An item analysis in each problem area and in the total questionnaire was undertaken to find the ten per cent most significant and the ten per cent least significant items in each category.

As a subsidiary device the writer developed a sequential analysis of themes, using the total highest ten per cent of items as a "group-protocol," which combines the principles of Murray's thematic and Klopfer's sequential techniques.

The Findings. Differences between percentages did not present statistical significance at P O .01 level. Several approached significance at P O .05. At this level a higher percentage in Personal Problems for girls had significant difference from boys' problems.

A pattern of higher percentages in urban area, females, and the fifth year level was apparent. Higher rank order percentages appeared in Curriculum-Teacher Procedures, Vocation and Social-Recreational areas. The lowest were Health, Home and Adjustment to School. (The last probably correlates with the school levels studied, where children are already adjusted to school.)

The item analysis revealed a highly consistent pattern of clusters among the various categories. Almost always the three same items were chosen in all cases.

The sequential analysis presented high correlation between the sequence of themes and the rank order of percentages mentioned above. However, the Financial area was the only exception. In the sequential analysis this area appeared in first place, while it appeared in eighth place in the rank order of percentages. It is apparent, therefore, that a few items dealing with finances allowed the largest group of students to reveal their deeper problems, though they were reticent to repeat them in many items. This reticence is probably due to the social prestige attached to wealth.

Conclusions and Recommendations. The analysis of findings indicates that the students' problems are closely related to the social, cultural and economic problems of the country as a whole and specifically to the rigid curriculum and traditional methods.

Recommendations are made to improve coordination of national and international programs for youth welfare, in the various areas and for the integration of community initiated programs.

Emphasis is given to the revision of school curricula and to the development of guidance services to facilitate schools' aims toward the continuity and breadth of personality development and social adjustment.

The study also produced a methodology for the design and utilization of a problem finding instrument which is adaptable to other times and places.

Microfilm $3.70; Xerox $12.60. 286 pages.

A COMPARISON OF THE MENTAL PERFORMANCES OF SUPERIOR AND AVERAGE NINTH-GRADE STUDENTS

(L. C. Card No. Mic 58-7504)

Eugene De Vere Koplitz, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Alanson H. Edgerton

The purpose of this investigation was to study the mental performances of two groups of ninth-grade students on an Essay Test, an Oral Problem-Solving Test, and the School and College Ability Test (Form 2A).

Many studies have dealt with objective test results as the major means for identifying superior and average students. This study was designed to determine the possible usefulness of an oral problem-solving test and as essay test as additional aids for identifying and understanding so-called average and superior students.

One-hundred and two ninth-grade students participated in this study. Fifty-one students were selected from high schools which expressed a willingness to cooperate with the University of Wisconsin Guidance Laboratory for Superior Students. Teacher-identified average students, selected from a representative Wisconsin junior high school, were tested at their school using the same laboratory test methods. Fifty-one ninth-graders were selected from a class of three-hundred and nine students by the principal and teachers.

The three sets of test results were then analyzed, using the following techniques:

1. The Essay Tests were read and evaluated by three qualified English teachers. Two scoring methods were used: Rank-Order and an Evaluation Sheet. The scores were arranged in a modified split plot design. Analysis of variance was used in the treatment of the data.

2. The Oral Problem-Solving Test protocols were dealt with in terms of a related check list. Mean frequency differences concerning each check-list factor were computed for both groups. The number of problems solved correctly constituted the test score.

3. The significance of difference between variance and mean scores of the two groups on the School and College Ability Test, Form 2A, was then computed. Mean scores for each group were compared with percentile ranks based on national norms.

The findings indicate that the teacher-identified superior and average students differed significantly in their performances on all three tests.

A difference between the mean scores on the SCAT, Form 2A, was significant at the .001 level. The variance among scores between the groups was significant at the .05 level. Comparing mean scores for each group with national norms, superior students ranked at the 99th percentile and average students at the 69th percentile.

Analysis of the Oral Problem-Solving Test protocols indicated that the superior students used more productive problem-solving methods than did the average students. The difference between mean scores of the two groups on this test was significant at the .001 level.

Essay Test results indicate that the three teacher-raters differentiated between the superior and average groups. A significant difference at the .001 level was reached, with the superior students receiving higher Rank-Order scores and Evaluation Sheet scores than the average students.

The investigation also showed that superior and average students who performed at either a high or low level on one test did not necessarily perform at a comparable level on all tests.

The general conclusion is that there was a significant difference between the performance of two groups of ninth-grade students identified as average and superior by their teachers. These findings indicate that, on the whole, teachers selected two groups of ninth-grade students who performed at different levels on the three test measures used. However, the methods employed in this study might well be used by school personnel to facilitate the identification of superior and average students. The results of these test measures should help guidance counselors, teachers, and school administrators to understand their students more fully. An interpretation of the test results should help students to gain a greater self-understanding.

In order that the methods used in this study might be improved and refined, further research is recommended. As a result of such continuous exploration and evaluation of new methods for identifying the level of students' mental performance, school personnel should be better equipped to understand and assist their students.

Microfilm $2.80; Xerox $9.60. 213 pages.

NON-INTELLECTUAL DIMENSIONS OF PERFORMANCE IN READING

(L. C. Card No. Mic 59-171)

John Michel, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Royal B. Embree

The purpose of this study was to identify non-intellectual dimensions of functioning personality associated with performance in a training program. Functioning personality was operationally defined in terms of study habits and attitudes, manifest needs, and modes of reaction to stress. The Brown and Holtzman Survey of Study Habits and Attitudes, the Edwards Personal Preference Schedule, and the Rosenzweig Picture-Frustration Study were selected to measure each of these variables. The basic proposition was that there would be significant differences in functioning personality variables before training among post course Improvement, Non-Improvement, and Attrition performance groups when chronological age, education, scholastic aptitude, and reading achievement were held constant. The results of measurement were related to performance within the structure of a reading improvement program. The data were analyzed in terms of sex of subjects and types of performance. The subjects for the research were 70 male and female college freshmen who volunteered for a non-credit, non-tuition reading improvement program and who were placed in advanced sections on the basis of reading rate and comprehension scores.

Major results were as follows:

1. There were no significant differences in study habits and attitudes among the Improvement, Non-Improvement and Attrition Groups.

2. There were significant differences among certain manifest need variables and types of performance. Male Improvers expressed a significantly lesser need for Deference and Succorance and a greater need for Change than Male Non-Improvers and Female Improvers. Female Improvers indicated a greater need for Deference and Succorance and a lesser need for Change than Female Non-Improvers and Male Improvers. Male and Female subjects whose scores differed from the profile pattern of their respective Improvement Group either did not demonstrate measurable improvement in the course or withdrew from the program. Non-Improvers and Attritions, male and female, were closely comparable to each other with respect to the significant manifest need variables.

3. There was a significant difference between the mode of reaction to stress and type of performance. Male Improvement and Non-Improvement Groups were less obstacle-dominated than the Male Attrition Group, while Female Improvement and Non-Improvement Groups were more obstacle-dominated than the Female Attrition Group. Improvers and Non-Improvers for both sexes were not significantly different on this dimension.

4. Distinct patterns of manifest need and mode of reaction to stress were established for the Male and Female Improvement Groups. Male subjects whose profiles of manifest need deviated significantly from the Male Improvement pattern and whose made of reaction to stress was similar to that of the Male Improvement Group remained within the program as members of the Non-Improvement Group. Male subjects with comparable manifest need deviations and whose mode of reaction to stress was significantly different from that of the Male Improvement Group withdrew from the program as members of the Attrition Group. A similar relationship existed among the Female performance groups.

The results of the experiment indicate non-intellectual dimensions of personality associated with performance, and suggest possibilities for additional research on the measurement and meaning of non-intellectual variables in relation to types of performance and sex of subjects.

Microfilm $2.00; Xerox $5.20. 104 pages.

HEARING EFFICIENCY...INEFFICIENCY AND PERSONAL-SOCIAL EASE...DIS-EASE

(L. C. Card No. Mic 59-174)

Duilio Thomas Pedrini, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Carson McGuire

The following schema applied to a person in a situation expresses the rationale of this research: behavior--perceiving, conceiving, expressing--personal-social ease... dis-ease. The variables of concern include foreground--client, examiner, technique--and background--present, past future--and their interaction in a time-space focus.

Generally, the problem of this study was to determine the personal-social ease...dis-ease of hearing efficient... inefficient individuals. Specifically, three samples of Air Force population of Class C hearers (noise-exposed, hearing loss), Class A hearers (noise-exposed, no hearing loss), and Class A_{nn} hearers (non-noise-exposed, no hearing loss), relatively equated on non-relevant variables, were compared for significant similarities and differences of ease--dis-ease. The techniques used for ease..dis-ease assessment included Figure-Drawing, Q-check, and case history data.

The hearing-loss C group differed significant in assessments of personal-social ease...dis-ease from the normal-hearing A and A_{nn} groups, which in turn did not differ significantly from each other. Hearing loss, per se, was the relatively isolated determiner of dis-ease differences between these groups. And most of the significant deviation between groups was contributed by the sub-C mild and moderate-loss individuals. The rest of the C's in this study, the borderline-loss individuals, did not differ significantly from the A's and A_{nn}'s. And furthermore the C borderlines also differed significantly from the C mild and moderates just as the A's and A_{nn}'s did.

Significant hearing loss, then, in the primary speech frequencies (500, 1000, and 2000 cps) can promote the reduction of ease in an individual, the increase of dis-ease. Because hearing is a vital form of communication in our society, the importance of adequate auditory perception should be emphasized. Perceptual activities, in general, especially those necessary in our culture, are considered fundamental in understanding the substance and process of personal-social ease...dis-ease.

On the basis of conjecture, belief, and a few investigations authors have entertained the proposition that extreme hearing-loss individuals and groups manifest less adjustment. Granting the extreme, this study attempted to pinpoint the subtle inroads of mild and moderate hearing-loss impairments. The entire gamut of significant hearing losses, then, seems to contribute to less ease, more dis-ease in our cultural setting. More intensive studies of the hearing-loss individuals are needed; hearing perception, not just hearing acuity, should be considered.

In behavioral-social research the approach in identifying, measuring, and controlling the variables of an organism in a situation can be inductive and/or deductive. The important aspects is to assess the organism/situation variables in keeping with principles of reasonableness and probability. Similarities as well as differences should be stressed. Randomization and replication should be regarded. If all these points are relatively achieved, validity, reliability, and predictive efficiency can be readily attained. As Carson McGuire maintains, in behavioral-social science the research goal should be a multidisciplinary study of man. In behavioral-social science the biological-psychological-sociological viewpoint in an organism-person-context schema is forwarded.

Microfilm $2.00; Xerox $6.60. 137 pages.

SOCIOMETRIC ANALYSIS OF AGE-MATE SENSITIVITY

(L. C. Card No. Mic 59-181)

Demas Jack Stinebaugh, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Carson McGuire

The investigation is designed to demonstrate that the sensitivity of adolescents toward one another can be measured meaningfully by a mathematical construct called a sensitivity-reflection index (SRI). The index, independent of other measures, represents the social impact or degree of recognition which a subject (Alpha) has among his or her peers (Betas). The sociometric instrument used yields nominations of Alphas by Betas who are regarded as members of a specified population in potential interaction with one another. Indices (SRIs) are calculated from weighted values for preferred/not-preferred nominations of friendship choice items. In addition, the sociometric form elicits nominations for behavioral models, role assignments, and operational attributes also used to test the hypotheses.

The adolescent population studied in the inquiry includes all members of the Textown High School who were graduated in 1954 (Laboratory of Human Development code D) and in 1955 (code E). The 224 boys and girls in both age-graded populations are from homes representing a cross section of family backgrounds.

Results of the study indicate that the sensitivity-reflection index (SRI) is useful as a means of estimating the social stimulus value of an adolescent. Furthermore, age-mate recognition has a significant degree of stability for most persons despite changes for individuals from year to year. One may predict from SRI values those individuals who are most likely to be regarded as positive and negative models as well as the kinds of roles to which an adolescent may be assigned in an age-mate society. Individuals with low SRI values seldom are chosen as models, frequently are regarded as "mice," seldom are assigned other roles, and rarely are evaluated as persons. Boys and girls with low degrees of recognition not only are left out and feel avoided or rejected by their peers but also lack the necessary kinds of experiences with models to be an effectively functioning person who can relate to and work with other people. Such adolescents could be recognized by professional people while young and be provided with a range of group situations and social activities that encourage interaction with age-mates and thus have the opportunity of learning appropriate patterns of behavior.

The use of nomination data to find SRI values seems to be a comparatively expeditious and inexpensive means of determining the degree of social recognition a boy or girl has among age-mates in an adolescent society. Educators are often surprised by the discrepancy between their own opinions and the values and disvalued assignments elicited by an index such as the SRI. Using such information enables a teacher or a counselor to concentrate not only upon those emulated but also to plan a range of learning experiences for persons usually left out of activities. The sensitivity-reflection index (SRI) affords a time-saving device which identifies categories of adolescents and provides the added advantage of employing the pooled judgment of the members of the adolescent society.

Microfilm $2.10; Xerox $7.40. 160 pages.

A COMPARATIVE STUDY OF THE SPEECH RESPONSES AND SOCIAL QUOTIENTS OF TWO SELECTED GROUPS OF EDUCABLE MENTAL RETARDATES

(L. C. Card No. Mic 58-7935)

Mamie Louise Thompson, Ph.D.
Indiana University, 1958

Statement of the Problem

The problem in this investigation was to compare the number of words, number of different words, the classification of these words according to parts of speech, and social quotients of a selected group of educable mentally retarded children in a private day school with a similar group in a residential school.

Procedures

Twenty subjects were selected from a private day school for mentally retarded children, and a similar group was selected from a state residential school for the mentally retarded. Subjects in each group were matched according to chronological age, intelligence quotient, and sex. The chronological age range of each group was from nine to sixteen and the intelligence quotient range was from fifty to sixty-eight.

The Stanford Binet Intelligence Scale was administered to determine the intelligence quotients, and the Vineland Social Maturity Scale was administered to obtain the social quotients of the subjects.

To secure information concerning the number of words and number of different words, a tape recording was made of each subject's responses to five selected pictures. Three minutes were allotted for subjects to speak about each picture. Words, used by each subject, were tabulated and classified according to parts of speech.

Correlation coefficients were computed to determine the relationship between intelligence quotients and social quotients for subjects in both groups. The $\underline{t}$ test was used to determine the mean difference between social quotients, number of words, and number of different words for both groups. To note the mean difference between subjects according to chronological age groups with respect to number of words, number of different words, and social quotients the $\underline{t}$ test was used.

The results of the study revealed the following: (1) A high relationship was found between the number of words and number of different words used by educable mental retardates in both groups. (2) A significant relationship was found between social quotients and intelligence quotients for both groups. (3) No statistical significant differences were found between the means of the two groups with respect to number of words, number of different words, and social quotients. (4) No significant differences were found between the means of the nine to twelve-year-olds and thirteen to sixteen-year-olds with regard to number of words, number of different words, and social quotients. (5) Results revealed that subjects at the private day school used more nouns, adjectives, verbs, and pronouns than subjects at the residential school. (6) The Relationship obtained between social quotients and intelligence quotients was higher for the institutional group than for the private

day school group. (7) Subjects in both groups spoke most about the picture that dealt with a home and family life situation, and least about the picture that dealt with an outdoor sports activity.

Microfilm $2.00; Xerox $4.20. 76 pages.

EDUCATION, TEACHER TRAINING

AN ANALYSIS OF THE INDUSTRIAL ARTS TEACHING POSITION AND TEACHER PREPARATION

(L. C. Card No. Mic 58-5201)

Cecil Richard Cain, Ed.D.
Indiana University, 1958

Statement of the Problem. The purpose of this study was to analyze the instructional and related requirements of the industrial arts teaching positions now held by persons who graduated from Fort Hays Kansas State College, Hays; Kansas State Teachers College, Emporia; and Kansas State Teachers College, Pittsburg, and to compare these requirements with the preparation these teachers had received.

Procedures. Persons chosen for investigation had a major or minor field of specialization in industrial arts and had graduated from one of these institutions during the period from June 1925 through June 1955. The study was confined to an examination of those graduates now teaching industrial arts in the public schools of the State of Kansas.

A fifty per cent sample, taken at random from a total of 329 industrial arts teachers, resulted in the selection of 164 persons for the investigation. The replies received from teachers and administrative officers revealed that 135, or 82 per cent, of the selected group met the established requirements.

An interview guide sheet was used as a means of eliciting information in the interviews conducted with each of the subjects. The data were compiled and analyzed under the following major headings: (a) teacher qualifications, training and activities; (b) instructional program, scope and area combinations; (c) shop equipment; and (d) ranking of objectives.

Findings and Interpretations. Wide variations in the preparation of the teachers, both in scope and in number of hours of credit in the various areas of industrial arts, indicated a diversity of requirements among the three teacher training institutions as to the type and amount of training considered desirable in the preparation of industrial arts teachers.

The predominance of drafting, metalwork, and woodwork in the program of course offerings at each of the grade levels pointed to a strong emphasis upon the traditional areas of instruction.

Since less than one-third of the group reported undergraduate courses in administration and supervision, apparently such courses were not required as a part of the preparation of industrial arts teachers. All of the graduates, however, reported administrative and supervisory duties in addition to their instructional responsibilities.

A limited scope of participation in extra curricular activities pointed out the failure of the prospective teachers to take advantage of the opportunity to become acquainted with the functions of various extra curricular activities in the school program. It was evident, however, that the demands of the teaching position may require the assumption of responsibility for the sponsorship of a variety of extra curricular activities.

There were 71 instances in which Kansas industrial arts teachers had assumed instructional responsibilities in subject matter fields for which they lacked the minimum subject preparation stipulated by the Kansas Study Department of Education for the class of school in which they taught. More than one-third of the teachers appeared to have a preparational deficiency ranging from one to 13 semester hours of credit in specific training for the various industrial arts subjects they taught. This seemed to indicate that formal preparation was subject to a variable interpretation by the State Board of Education in the determination of the teacher's qualifications in the industrial arts teaching field.

The wide variations in the kinds of equipment available for instructional purposes may reasonably be considered to be indicative of the nature and extent of the teacher's training, as well as the budgetary limitations of the local situation.

In the consideration of industrial arts objectives, the teachers were in close agreement as to the two objectives they ranked as least important; interest in industry and socio-economic understanding. No stereotyped pattern of emphasis of objectives existed among the instructors engaged in the training of industrial arts teachers.

Microfilm $2.75; Xerox $9.60. 212 pages.

IMPLICATIONS FOR INDUSTRIAL ARTS TEACHER EDUCATION FROM CASE STUDIES OF SELECTED TEACHERS

(L. C. Card No. Mic 59-327)

Maurice F. Foss, Ed.D.
University of Cincinnati Teachers College, 1958

Chairman: Carl W. Hansen

Problem. The problem was to study a selected group of graduates of the Industrial Arts Education Department of Miami University, Oxford, Ohio, to determine the personal, social, experiential, and educational factors involved in their adjustment to teaching. It was hoped to identify some characteristics and experiences of superior and of less satisfactory teachers, and to find a relation of these factors to teaching success.

Procedure. There were two sources of data. Campus data included high school and college grade records, application forms, entrance tests, and general and professional recommendations. Visitation data was obtained during a half day of observing classes, interviewing the teacher and principal, or superintendent. Individual case reports were prepared from the data.

Teaching performance was judged on a rating scale, and the teachers were rated superior, satisfactory, and less satisfactory. Means of all data were determined for the superior and less satisfactory teachers.

Findings. The pattern of the superior teacher:

The students were profitably busy. Personal relations were excellent. Teachers and administrators worked closely together. As a student, the superior teacher came to college to prepare to teach, usually industrial arts. He had a reputation for being industrious, enthusiastic, and able to work with people. Entrance tests placed him in the lower half of his class. He graduated in the upper half of his class. His philosophy of education expressed an interest in children, and a belief in the school as an instrument of society. He earned the Master's degree soon after entering teaching.

Among the poorest teachers, the following was noted:

Student work was limited, and of poor quality. Personal relations between students and teachers were poor. The administrator saw little value in industrial arts and questioned the value of the program. Teaching had been neither the first or second vocational choice of the teacher when he entered college. Psychological entrance tests placed him above the fiftieth percentile, but achievement tests and position in graduating class placed him in the third quarter of his class. He had limited recommendations, which failed to mention ability to work with people. His philosophy of education mentioned work with materials, but not with students. He had not earned the Master's degree.

Teaching success is undoubtedly influences by a combination of teacher characteristics and situational factors. Teachers should consider physical facilities, class size, administrative attitude, and individual ability and willingness to work in the particular area.

Administrators should note areas in which the student is well prepared. College ratings are generally so high that they are worthless, but key words appear to be "ability to get along with others, cheerful, cooperative, initiative, and responsibility."

Industrial arts freshmen tended to be marked low in leadership even when they had served successfully as group leaders in Scouts, Four-H, and similar organizations. Senior ratings did not discriminate between potentially poor and superior teachers.

Industrial arts teachers should have student-teaching experience in a shop area. Increased experience with children is desirable throughout the college program. Professionalized technical courses are needed at the graduate level.

It would not have been possible to predict teaching success on the basis of recorded campus data.

Microfilm $6.45; Xerox $22.60. 507 pages.

THE EVALUATION OF SUPERVISION OF SECONDARY-SCHOOL SCIENCE INSTRUCTION

(L. C. Card No. Mic 59-393)

Verlin Wiley Lee, Ph.D.
The Ohio State University, 1958

Purpose and Scope of the Problem

The purpose of the study was twofold: (1) to ascertain the present status of supervision of secondary-school science instruction at the state and local levels and (2) to evaluate the performance of supervisory activities in the light of established values procured through the judgments of a jury of twenty-five science educators. All supervisors who devoted one-half of their time to the supervision of secondary-school science instruction were included in the study.

Methods and Procedures

State departments of education were asked to give the status of science supervision and the location of science supervisors throughout their respective states. Check list-questionnaires were sent to thirty science educators to obtain values concerning the importance of 106 supervisory activities. Forty-four local and ten state science supervisors were sent similar check list-questionnaires to determine the extent of performance of the activities. An 84 per cent return was obtained from the jury and the local science supervisors; a 60 per cent return was obtained from the state supervisors. The research method used was the survey-appraisal type, and more specifically the jury technique. Statistical treatment included the use of the coefficient of correlation, rank correlation, and the Null Hypothesis.

Summary of Findings

The 106 supervisory activities were placed in eight major categories. Analysis of the data obtained from the jury showed that the rank order of importance of the categories of activities used in the study was (1) methods, (2) curriculum study, (3) research, (4) in-service growth of teachers, (5) self-growth, (6) public relations, (7) administration, and (8) materials and equipment.

Only six state departments of education employed full- or part-time science supervisors. Supervision of science was usually carried out by general supervisors. The primary functions of the general supervisors were regulatory in nature. Recent developments to upgrade science teaching took the form of workshops and institutes. Science teacher improvement program had been initiated in several states. The median number of years the state supervisor had been in their position was two. Each supervisor had at least a master's degree and considerable teaching experience.

The activities performed most extensively by the state supervisors were in the category of administration. The activities performed least extensively were in the category of research. A slightly significant coefficient of correlation of +.45 was obtained between the values placed upon the activities and the performance of the activities by the state supervisors. Comparison of values given each activity with the actual performance showed that in almost every instance the values obtained from the jury were higher than the extent of performance by the supervisors. The major factors responsible for these differences were the lack of consultative aid and an area too large to serve adequately.

Similar differences between the values and the performance of the activities by the local supervisors were found. However, a higher correlation was found in the case of the local supervisors (+.53). The most extensively performed activities by the local supervisors were in the methods category; the least extensively performed were in the research category. Obstacles that hindered optimum programs were lack of consultative aid and inadequate budgets. The formal education, teaching experience, and enthusiasm of the 43 state and local supervisors appeared adequate.

The greatest need for the future in the field is more consultative aid to carry on programs that will more nearly correlate with the values expressed by leading science educators. Microfilm $4.55; Xerox $15.40. 356 pages.

A SURVEY OF INTRODUCTORY AUDIO-VISUAL LABORATORY PROGRAMS IN SELECTED COLLEGES AND UNIVERSITIES

(L. C. Card No. Mic 59-321)

Edwin M. Logan, Ed.D.
University of Virginia, 1958

The purpose of this study was to determine the laboratory activities provided and the various practices followed in introductory audio-visual laboratory programs of selected institutions of higher learning throughout the United States. On the basis of the findings of this study, recommendations were made as to what would constitute an adequate introductory audio-visual laboratory program at the college level.

After examining numerous printed materials and contacting various resource persons, the writer devised and submitted a questionnaire to 193 schools. These institutions, from each of the forty-eight states, had been recommended by state audio-visual directors or their counterparts. Of those schools recommended, 184, or more than 95 per cent, were able to participate by completing a questionnaire, from which data were obtained for use as the basis for this study.

Various general practices were usually followed in the laboratory programs studied. It was found that the introductory audio-visual course was usually a combination of both laboratory and lecture. Most schools had a room, separate from the classroom, equipped for laboratory work. While no particular pattern emerged when schools appraised their laboratory facilities, a slight majority of them considered their facilities, including darkroom, storeroom, equipment, materials, space, and acoustics, as being partially adequate. Although it was revealed that the time allotted to laboratory work varied, between one and two hours were generally devoted to it per week. Laboratory work was usually pursued during junior, senior, or graduate study years with the junior year being slightly preferred over the others. Laboratory classes were comprised mainly of education students. Though the sizes of groups into which students were divided to work on laboratory exercises varied, the groups usually ranged from one to five members. Nearly two-thirds of the institutions provided laboratory exercise guides in some written or printed form, while the remaining schools furnished no written exercise materials for student use.

In its laboratory program, the average school presented experiences involving twenty-six different exercises among which were included ten on equipment, nine involving production, four on evaluation, one pertaining to photography, one on duplication of materials, and one of a miscellaneous nature.

The importance of each introductory audio-visual laboratory exercise was also judged by the instructors participating in this study. Among the exercises considered most valuable, in the order named, were those involving the sixteen millimeter sound motion picture projector, filmstrip projector, evaluation of films, tape recorder, 2" x 2" slide projector, evaluation of filmstrips, opaque projector, field trip, bulletin board, evaluation of free materials, preparation of materials for opaque projection, and evaluation of recordings. Other exercises considered important, in descending order of their value, were those involving the overhead transparency projector, feltboard, record player, exhibits and displays, picture mounting, transparency preparation, 3 1/4" x 4" standard slide projector, evaluation of radio programs, charts and graphs, poster making, handmade slides, television, lettering, and radio.

The study further determined that students were taught to use from one to three different equipment models. Also considered were the aspects taught in conjunction with projection, motion picture projection, and audio equipment. Among those aspects taught, common to all types of equipment, were: operation and utilization, nomenclature and function of basic parts, simple care and maintenance, criteria for selection, names and addresses of manufacturers, and costs of equipment.

Various laboratory instructional practices were discovered and critically examined. Findings indicated that a high degree of student performance was always required, however, many institutions did not always afford students an opportunity to utilize aids in instructional situations. Moreover, written instructions for exercises were not provided in numerous instances, nor was an appraisal generally made of the laboratory work of the students by instructional personnel.

Suggestions were also received from many laboratory directors for improving the laboratory program. These comments pertained to administrative aspects, organization of the laboratory program, content and scope, instructional practices, and other related aspects.

On the basis of the findings of this study and the best judgment of the writer as to what would constitute an adequate audio-visual laboratory program at the college level, a program of introductory laboratory exercises, including suggestions as to what general and instructional practices are considered most desirable, was recommended.

Microfilm $4.80; Xerox $16.00. 374 pages.

THE EFFECT OF SELECTED FACTORS UPON COMPOSITION DELEGATED BY EMPLOYERS TO SECRETARIES IN MANUFACTURING CONCERNS

(L. C. Card No. Mic 59-399)

Jean Dancer Lunn, Ph.D.
The Ohio State University, 1958

The purpose of this study was to find out how the education and training of secretaries could be improved in the area of composing business communications by determining whether factors such as the age, salary, education, training, and experience of the secretary; the position, education, and experience of the employer; the company size or the presence of dictating equipment in the office; and the attitudes of both secretaries and employers toward dictation and composition had any effect on the delegating of composition by employers in manufacturing concerns to their secretaries.

One hundred employers engaged in manufacturing in Columbus, Ohio, were interviewed, and questionnaires were filled out by one secretary working for each employer to furnish the data for the study.

The data were treated by the use of the chi square statistic to determine whether or not the selected factors and composing were related.

The major findings were that the secretaries who received the higher salaries were among those who composed most frequently; the age, education, or experience of neither the secretaries nor the employers affected the delegation of composition; there was no relation between composition done by the secretary and the method used (the majority used the typewriter) for composing.

Secretaries who liked to compose and those who were required to compose to secure their jobs composed more frequently than did those who did not qualify for these categories. The attitudes of employers and secretaries toward dictation and composition had no effect on the composition delegated.

There was no relationship between the employers' thinking that secretaries should be able to compose and the composing done by the secretaries. Thirty-seven per cent of the secretaries started to compose on their first jobs, but none of the companies included in the study gave any training in business writing to their employees. Employers were not always aware of how frequently their secretaries composed.

There was no relationship between the reports and letters composed by the employer and the same types of communications composed by the secretary; there was a relationship between the telegrams, teletype messages, interoffice memorandums and notices to employees composed by the employer and those composed by the secretary.

The only ability of the secretary in the opinion of the employer which was related to composing was the secretary's knowledge of English and grammar.

The duties performed by the secretaries which were related to composing were those duties which called for more initiative than did the other duties.

The following conclusions may be drawn from this study:

1. There appears to be a relationship between the initiative of the secretary and the amount of composing done by her.
2. Students who are prepared for secretarial work can be more valuable to their employers if they know how to compose letters and reports before they leave school to obtain employment.
3. There is need for better communication between the employer and the secretary if the secretary is to do an increased amount of composing.
4. Secretarial students need to be thoroughly trained in the use of the English language and in grammar, spelling, punctuation, and proofreading.
5. Employers may not know how to delegate responsibility for writing to their secretaries.

Microfilm $2.00; Xerox $9.00. 199 pages.

IMPLICATIONS FOR THE PUNJAB STATE FOUND IN SELECTED PROFESSIONAL EDUCATION PROGRAMS FOR THE PREPARATION OF SECONDARY SCHOOL TEACHERS IN THE UNITED STATES

(L. C. Card No. Mic 59-421)

Jagjit Kaur Sandhu, Ph.D.
The Ohio State University, 1958

The purpose of this investigation was to study the professional education program of secondary school teachers in the Punjab state of India and in selected teacher education institutions in the United States, to find implications of practices studied in the United States for improvement of practices in the Punjab state.

Four teacher education institutions in the United States were visited for one or two weeks each and their professional education programs studied through observation of required classes in professional education, through interviews with students and staff members, and through published material. Five other professional education programs in the United States were studied carefully through available literature. The teacher education program of the Punjab state, India, was analyzed from published reports.

The salient features in the professional education studied in the United States were decentralized control of teacher education, provision for general education, the professional education program as a part of the undergraduate curriculum, the required sequence in the professional education courses, practical experience as an integral part of theory courses, the organization of professional education courses into large integrated units, the use of a variety of methods in instruction, the internal assessment based on the work done in a given course, and the placement and follow-up of students by the institution.

The salient features in the professional education program for preparing secondary school teachers in the Punjab state were centralized control of teacher education, a separate post-degree program of professional education, the offering of all professional education courses concurrently (except student teaching which is offered late in the curriculum), almost no practical experience as part of theory courses, the almost exclusive use of the lecture method of instruction, the external assessment based on the final essay-type examination, and student teaching after the theory courses.

In the Punjab state the five-year teacher education program should be coordinated. The basis of selective admission should be fairly comprehensive in order to make selection more effective. There should be continuous selection of students during their stay in the college. One-third of the time spent by prospective teachers in the College of Arts and Sciences should be devoted to general education. No student with inadequate background in the field of specialization should be admitted to the professional college, and the field of specialization should be related to the level of adolescent development of the pupils to be taught.

Practical experience should be an integral part of theory courses in professional education. General psychology and introduction to education courses should be offered before the professional concentration. History, philosophy, and sociology of education should be offered in one unit entitled "Foundations of Education." Educational psychology courses should deal with a wide variety of problems, covering a range commensurate with teachers' needs.

Observation and participation experience with young people should be required before student teaching, and the student teaching assignment should be extensive. In the evaluation of student teaching, approximately 50 per cent of the final grade should be based on work done during the entire teaching period and approximately 50 per cent on the two final lessons given by the student. The lecture method of instruction should be supplemented by other methods. The external examination should continue at present, but one-third of the marks in each course should be allotted to work done during the session. The training colleges should provide placement and follow-up service.

Microfilm $3.50; Xerox $12.00. 271 pages.

EDUCATION, THEORY AND PRACTICE

THE RECREATIONAL FUNCTION OF INDUSTRIAL ARTS EDUCATION, AN ANALYSIS OF POSITION, POTENTIAL AND DIRECTION

(L. C. Card No. Mic 59-361)

John Samuel Biedler, Ph.D.
The Ohio State University, 1958

This study is concerned with the problem of using the freedoms for recreation produced by modern technology. It seeks to determine the position of industrial arts in contributing to the use of these freedoms in maintaining balanced living through recreation. The timeliness of this study is evident when one considers that man now has harnessed sufficient power to relieve him of arduous labor and to produce the materials for a high standard of living. Man must now concentrate on learning to direct this power and its products.

The major hypothesis dealt with here is that industrial arts is voluntarily made a part of recreational activities and consequently demands conscious direction in the educational effort.

The picturing of a position of industrial arts education relative to its recreational function was accomplished by documentary research, observation, correspondence, field experience, critical analysis, and interpretation.

Findings

The major findings resulting from this study are divided into three groups revealing position, potential, and direction for expanding the recreational function of industrial arts education.

Findings revealing position:

1. Recreation as re-creation is movement toward balance.
2. There exist certain factors conditioning man's recreation in such a way as to represent forces needing consideration.
3. Through comparative analysis, many aspects of the two efforts—recreation and industrial arts education—are revealed as coordinate, each having much to offer the other.

Findings revealing potential:

1. Technology continues to present man with ever more opportunities for recreation, during both work and leisure.
2. The trend toward individual participation and application in the effort to satisfy current needs and desires, or the "do-it-yourself" movement, is found to involve many of the activities typical of industrial arts education.
3. The harnessing of power means many more opportunities for recreational experiences if the resources are likewise developed. The analysis of recreational activities reveals a rich content of industrial arts, representing a distinct opportunity for development.

Findings revealing direction:

1. The freedom produced by technology represent re-creational opportunities in ever increasing numbers, as well as possibilities for negative movement or outcome. The freedoms, therefore, demand educated use.
2. The expanding of the recreation function of industrial arts education is necessary in view of the increasing importance of learning to spend a living as opposed to directing educational effort toward learning to earn a living.
3. The unique characteristics of the industrial arts program, its staff and facilities, make it well qualified to serve in the leadership training efforts of the recreation program.

Conclusions

Education offers the most acceptable means of bringing about truly re-creational experiences. These activities as industrial arts represent increasingly valid opportunities for self-expression. As such they represent a much needed force to offset the many sedentary types of recreation which prevail.

Industrial arts, as the area designed to interpret industry, meets its responsibility more fully only when it guides students in recognizing and making the most of the recreational opportunities produced by a culture that is technological. Microfilm $2.15; Xerox $7.60. 162 pages.

A STUDENT-EXPERIENCE-DISCOVERY APPROACH TO THE TEACHING OF THE CALCULUS

(L. C . Card No. Mic 59-367)

Kenneth Burdette Cummins, Ph.D.
The Ohio State University, 1958

Since the turn of the century thinkers such as John Perry, E. H. Moore, and others, have emphasized with pressing urgency that mathematics should be taught in such a way that it has more meaning for the students. Writers on the teaching of the calculus are also concerned and they recognize the need for a type of teaching which will foster deeper understanding of the concepts and structure of the calculus. This emphasis is needed to thwart the danger that calculus come to be regarded by students as a group of unrelated manipulative skills. Encouraged by the effectiveness of inductive-experiential methods of teaching in other mathematical subjects, the wirter suggests that this approach may show promise in the teaching of the calculus at the university level as well.

This study proposes to provide evidence in testing the assumption that a student-experience-discovery approach to the calculus produces more proficiency and understanding than do other methods of teaching which are so often found at the undergraduate university level.

To test this assumption the following procedure was used:

1. Some representative texts were studied to assist in organizing a course in first-quarter calculus.
2. Study-guides were prepared to be used by the student and the teacher to encourage a maximum of student discovery and, with the aid of the teacher and classroom discussion, to help the student develop much of the calculus structure by his own effort. The general principle used was to encourage the making of generalizations from numerical examples to lead to a substantial logical structure of the calculus.
3. This experimental course was given to one section of Kent State University, Kent, Ohio, throughout each of the three quarters of the year 1957-1958. Two of these sections were cross-tested with traditionally taught groups. A statistical comparison was made during the Winter Quarter; this statistical study used ACE scores, a pre-calculus test score, a previous mathematics average grade score, and results on cross-tests made by teachers of both sections and given to both sections.
4. The effectiveness of this student-experience-discovery approach was further evaluated by making use of two additional resources: (a) student reactions secured through an evaluation questionnaire and (b) student thought as indicated in a paper "What I Conceive the Calculus to Be."
5. There was made also a modest study in change of attitude toward mathematics.

Statistical results show that the experimental section performed significantly better on tests on understanding the calculus and scored just as well on manipulative problem-solving proficiency. Hence the students who studied under this discovery approach seemed to understand better the nature and structure of the calculus and, in addition, they experienced the thrill of being a part-creator of the subject.

The encouraging results from this experiment are sufficiently convincing not only to give the writer further impetus to continue his investigations but also to recommend that college teachers of mathematics explore the effectiveness of this method in their calculus courses as well as in other teaching areas.

Microfilm $4.70; Xerox $15.80. 366 pages.

CONTRASTING PHILOSOPHIES OF EDUCATION: NUNN AND DEWEY

(L. C. Card No. Mic 59-377)

Mengesha Gebre-Hiwet, Ph.D.
The Ohio State University, 1958

It was the over-all purpose of this study to grasp the significance of the educational philosophies of Sir Percy Nunn, a distinguished English educator, and of Professor John Dewey, a distinguished and widely acclaimed influential American educator. Its specific purpose, however, was to distinguish the nature of the difference in the educational views of these outstanding thinkers and practitioners in education.

The study consists of four parts. Part I deals with Nunn's educational view; Part II presents that of Dewey. An effort has been made in Part III to show the differing emphasis these educators place on critical points of educational concern, such as freedom, control, and individuality. Part IV summarizes the study.

This study finds that Nunn's chief educational effort is to promote and enhance "individuality." In his view individuality is the goal of life which education must help to foster. To this end, therefore, he insists that practices in education should accord with the truth that "nothing good enters into the human world except in and through the free activities of the individual men and women."

It, also, notes Dewey's chief contention, on the other hand, that education is a process of "growth," the end of which is "further growing." The function of education, then, is the creation and maintenance of social conditions that make possible the maximum growth of all. Dewey is no less concerned with the individual; he is, however, more sensitive to the force of social conditions in shaping the individuality Sir Percy Nunn prizes.

Each educator is clearly motivated by an interest in improving the conditions of development for present and future generations and each is sure that formal education is a significant means of bringing about this improvement. Their concern to carry into the future those qualities of the free man which their tradition has accentuated is clearly noticeable, a fact which is of especial interest at this moment when the cause of freedom is endangered in those quarters of the world where totalitarian practices are now common. Both Nunn and Dewey advocate democracy as a political and social concept that prizes a life which is moral, rational, and free. Each denies the reality of superpersonal entities and of absolute values and standards that lie beyond the experience of man.

The study reveals no marked difference in their educational contentions. Such difference as exists is more a matter of emphasis than of kind. Dewey does appear to be more critical of traditional subject matter than is Nunn. The latter is concerned with the improvement of the way subject matter is used in teaching. This interest is shared by Dewey, but he recognizes more explicitly than does Nunn that the subject matter of the specialist is not identical with the subject matter of the teacher. Nunn places a distinct emphasis on the development of distinctively unique elements in individual life, whereas Dewey emphasizes the social ideal through which individual life is to be enriched as the common interests of men are extended. It is not inappropriate to conclude that there are more traces of the philosophy of idealism in Nunn's position than in Dewey's. Each educator, however, is committed to an education that holds freedom to the fore as a central and controlling value. Microfilm $2.00; Xerox $5.20. 103 pages.

OBSTACLES TO THE DEVELOPMENT OF REFLECTIVE THINKING IN THE SECONDARY SCHOOL AND PRACTICES USED TO OVERCOME THEM

(L. C. Card No. Mic 59-378)

Aklilu Habte, Ph.D.
The Ohio State University, 1958

The purpose of the study was to investigate the major obstacles which secondary school teachers face in developing reflective thinking in their students and the practices they use to overcome these obstacles. The following procedures were followed:

1. The literature that deals with obstacles to the development of reflective thinking was studied, and a questionnaire was prepared, in the light of the derived generalizations, and sent to leaders for validation and suggestions.
2. The revised questionnaire was sent to selected teachers for further validation and for identifying illustrations of successful practices.
3. In addition, six selected schools were visited by the investigator.

The following statements were identified as obstacles to the development of reflective thinking:

(1) Teachers' lack of understanding of reflective thinking and its role in individual and group behavior. (2) Teachers' lack of skill in guiding students in the development of reflective thinking. (3) Teachers' lack of competency in the subject matter of instruction. (4) Teachers' lack of conviction in the values of reflective thinking. (5) Teachers' use of conventional, less time-consuming methods of teaching because of over-loaded schedules, large classes, and so on. (6) Teachers' emotions, feelings, disturbances and/or mental blocks. (7) Disagreement among educators on the applicability of reflective thinking to certain problems of living. (8) Failure of teacher-education institutions to prepare teachers and administrators to utilize reflective thinking. (9) Continued pressure of colleges for conformity to prescribed entrance requirements. (10) Lack of basic research on the nature of problem-solving operations at various developmental levels. (11) The presence of faulty theorizing about problem-solving processes. (12) Overemphasis by teachers, school administrators, and lay public on the transmission of the social heritage as a major purpose of education. (13) Intellectual dishonesty of school administrators who pay only verbal allegiance to the values of reflective thinking in the school program. (14) The fixed and prescribed nature of the school curriculum. (15) Lack of adequate instructional materials for teaching reflective thinking appropriate to the intellectual level of students. (16) Lack of adequate instruments for evaluating the progress of student in learning to think reflectively. (17) The presence of "shunned or closed" areas of inquiry in the school and the community. (18) Lack of family and community understanding of the values and contributions of reflective thinking. (19) The unquestioned acceptance by the family and community of strong traditions, prejudices, creeds, ideas and institutions. (20) Reliance of people upon dogmas or absolute ideologies. (21) The prevailing use of extensive propaganda in the community. (22) Anxiety on the part of community, family, and teachers which leads individuals to seek final solutions to problems of deep concern rather than to assume an attitude of open inquiry. (23) Students' use of faulty language expression or comprehension and/or the lack of adequate vocabulary. (24) Inability of students to detect erroneous conclusions resulting from false logic in reasoning and the lack of instructional provision to cultivate logical thinking. (25) The paucity of students' experiences in quality and quantity resulting from low socioeconomic family status.

The practices indicated from the literature, the writer's visitations, and teachers' responses cover a wide variety of activities. The major areas include such activities as programming workshops and in-service education; conducting staff meetings; enrolling in higher institutions; undertaking research projects; utilizing a plurality of approaches in classroom procedures; observing successful classroom teachers; and participating in professional organizations.

The recommendation is made that teacher-education institutions and secondary school teachers and administrators consider including the identification of obstacles to the development of reflective thinking as one aspect of their professional activities.

Microfilm $4.60; Xerox $15.40. 359 pages.

A COMPARATIVE ANALYSIS OF FOUR INSTRUCTIONAL METHODS IN EIGHTH GRADE SCIENCE

(L. C. Card No. Mic 59-320)

Stanley Ausburn Huffman, Jr., Ed.D.
University of Virginia, 1958

Purpose of the Study

The purpose of this study was to verify the following null hypothesis:

There are no significant differences in learning factual science information at the eighth grade level when taught by each of four methods. These methods are as follows: (1) lecture-description, (2) lecture-film, (3) lecture-demonstration, and (4) lecture-film-demonstration.

Procedures of the Study

Eighth grade exploratory science students were randomly selected and assigned to four sections for the experimental investigation. Each section was taught four units by one of four instructional procedures for four weeks.

The testing pattern consisted of a series of three tests for each of the units taught. A pre-test was given to ascertain whether any group was significantly different from any other prior to the periods of instruction. In order to determine the differences in the acquisition and retention of factual science information a post-test, immediately following an instructional period, and a delayed recall test, four weeks after the completion of a unit, were administered.

The t-test was used to establish the statistical significance of the differences which existed between the groups as a result of the four instructional procedures. Significance was determined at the .01 level of confidence.

Findings of the Study

The pre-test results showed that none of the differences between groups was significant. This means that the gain of each group was about equal in science subject matter knowledge about a specific area prior to the instructional periods. The results of the post-test revealed

that no significant differences existed between any of the groups in regard to the four instructional procedures used. Each group, however, showed gains in factual information from the instructional period when measured in terms of immediate recall. When factual information was measured in terms of retention by a delayed recall test, it was also found that no significant differences existed between groups as a result of any of the four procedures of instruction. Thus, each group profited equally from instruction.

Conclusions of the Study

The following conclusions have been formulated:

1. The null hypothesis was verified. There were no significant differences in learning factual science information at the eighth grade level when taught by each of four instructional methods: (1) lecture-description, (2) lecture-film, (3) lecture-demonstration, and (4) lecture-film-demonstration.

2. Each of the four methods was effective as a means of instruction when used singly or in combination.

3. No one of the methods was superior to any other of the methods at the expense of the latter.

Microfilm $2.25; Xerox $8.00. 171 pages.

A MEASUREMENT AND INTERPRETATION OF MONEY MANAGEMENT UNDERSTANDINGS OF TWELFTH-GRADE STUDENTS

(L. C. Card No. Mic 59-328)

Herbert Mahlon Jelley, Ed.D.
University of Cincinnati Teachers College, 1958

The purpose of this study was to determine the money management understandings of second-semester high school seniors. The four major steps in the study were: (1) to isolate the topics dealing with money management which are of greatest importance; (2) to determine the extent of 12th-grade students' understandings of these money management topics; (3) to analyze and interpret the knowledge evidenced by students differing in socio-economic status, academic achievement, and sex; and (4) to indicate how the evidence gathered can be used in curricular planning.

To collect the data for this study, it was necessary: (1) to prepare a test and an interview guide, (2) to select the individuals to be surveyed, and (3) to administer the tests and conduct the interviews. To assist in the preparation of the test and the interview guide used in this study, a test plan was constructed by analyzing certain textbooks and by obtaining opinions from a jury of experts.

The test was administered to 603 seniors in five high schools in the Cincinnati, Ohio, area. One hundred and two of these seniors were interviewed. The 603 seniors were divided into three socio-economic classes by using the Minnesota Scale for Paternal Occupations. The students were also divided into three academic achievement groups on the basis of the grade-point averages which they earned during their last three years in high school.

A comparison was first made of the understandings evidenced by students who differed in socio-economic status. These comparisons can be summarized as follows:

1. Students from the upper socio-economic class scored significantly higher than students from the middle socio-economic class on items which measured borrowing money and using credit. Students comprising the middle class, in turn, scored very significantly higher than the students who comprised the lower class.

2. No significant differences existed between the performance of students from the upper and middle socio-economic groups on the section of the test which measured managing personal finances. On the other hand, a significant difference did exist between the scores of the middle and lower groups.

3. The insurance section of the test revealed the largest differences among the three socio-economic classes. The students who comprised the upper socio-economic class scored very significantly higher than the students from the middle class, and the students from the middle socio-economic class scored very significantly higher than the students who comprised the lower class.

The second comparison considered the differences in understandings which exist among three academic achievement groups. On all three sections of the test, it was found that the students who comprised the higher academic achievement group scored very significantly higher than the students who made up the middle group. Likewise, on all three sections of the test, the students comprising the middle achievement group scored very significantly higher than the students who comprised the lower group.

The differences between the understandings of male and female students constituted the final comparison made. On the section of the test which measured insurance understandings, the mean score of male students was significantly higher than the mean score of female students. On the other sections of the test, the differences were not statistically significant.

Microfilm $3.75; Xerox $12.60. 289 pages.

THE RELATIONSHIP BETWEEN EXPRESSED INTERESTS AND LISTENING SKILLS OF CHILDREN IN THE SIXTH GRADE

(L. C. Card No. Mic 58-7924)

Milton E. Marten, Ph.D.
Indiana University, 1958

Summary

Problem. The purpose of the study was to determine the relationship between expressed interests in specific subject matter and listening skills employed when the subject matter is presented orally. Additional variables of sex, socio-economic status and intelligence were likewise considered in the study.

Procedure. An interest inventory and a matched listening test were administered to 285 pupils in nine classrooms during the first week of May, 1958. Both instruments were written specifically for this study. The ten significant areas of the interest inventory were assessed in three ways, but yielded a total listening index. This index was compared to the listening performance of children in answering eight questions for each of the ten selections read to them. For each selection a question tested the ability to (a) recall a simple fact, (b) identify the main idea or correct title, (c) note subordinate facts, (d) recall the sequence of events or ideas, (e) catch inferences or implications, (f) recognize relevancy or irrelevancy of materials,

(g) differentiate between fact and opinion, and (h) note the point of view of the writer.

The schools were so selected that they provided subjects of three distinct socio-economic levels.

By selection of cases within the total population tested it was possible to arrange subgroups of sexes, various levels of intelligence, and various levels of listening ability.

Scores of the Henmon Nelson Test of Mental Maturity recorded on the school records were used in all 245 usable cases. There were 123 girls and 122 boys included in the computations.

All data were coded on IBM cards and correlations were obtained through IBM processes.

Findings

1. Children of various socio-economic levels showed little difference in listening ability when intelligence was held constant.
2. The correlation between expressed interests and listening was virtually zero.
3. Boys scored higher than girls on all parts of the listening test. Though their advantage was slight, it was statistically significant.
4. A positive correlation was shown between listening performance and intelligence, but variations in results indicated that other factors in addition to intelligence influenced listening.
5. Performance of recall listening skills was superior to that of critical listening skills.
6. Of the skills tested that of recognizing the main idea or the correct title was most frequently performed correctly.
7. Pupils found difficulty in discerning relevancy of material and distinguishing fact from opinion.
8. Boys showed stronger interests in more things than did the girls.
9. Pupils with low intelligence and those with poor listening ability expressed stronger interests than did those of higher intelligence and those with better listening skills.

Conclusions

1. Socio-economic status in itself is no factor in determining listening ability.
2. There is no relationship between expressed interests of children and either their recall listening ability or their critical listening ability.
3. Boys are superior to girls in listening ability.
4. Listening ability and intelligence are related as shown by positive correlations.
5. Skills involved in critical listening provide more difficulty than skills of recall listening.
6. Listening is a complex activity made up of numerous skills, and influenced by numerous variables.
7. Boys tend to express stronger interests than girls.
8. Children of lower socio-economic status tend to express stronger interests than those of higher socio-economic levels.
9. Children of lower intelligence tend to express stronger interests than those of high intelligence.

Microfilm $2.20; Xerox $7.80. 166 pages.

AN EXPERIMENTAL STUDY TO DETERMINE THE EFFECT OF MOTION PICTURES IN REINFORCING INSTRUCTION FOR THE IMPROVEMENT OF SPEAKING TECHNIQUES OF STUDENTS IN BEGINNING PUBLIC SPEAKING CLASSES

(L. C. Card No. Mic 59-322)

Clyde W. McElroy, Ed.D.
University of Virginia, 1958

The purpose of this experiment was to determine if the use of motion pictures to reinforce instruction affected the improvement of speaking techniques of beginning public speaking students. To determine the extent that films were currently used as instructional devices, a survey of randomly selected colleges and universities was undertaken. The results indicated that exactly one third of the institutions polled use motion pictures. But a careful perusal of research in the field of speech offered no evidence of experimentation with films as reinforcement of instruction.

A total of fifty-three beginning public speaking students from the University of Virginia participated in the experiment, providing two experimental groups and one control group. An analysis of the subjects found that the groups were similar in sex, year at the university, average age, and state of residence. The same instructor taught all groups.

In keeping with the purposes of the study, five films were selected to reinforce specific segments of instruction. Appropriate methods of film usage were followed as the students in the experimental groups received preparation for the films and participated in a discussion following the showings. The control group received classroom instruction equivalent to that of the experimental groups. The only difference in instruction was the use of motion pictures for reinforcement of the five areas under study in the experimental groups, while lectures were used to reinforce these areas in the control group.

A panel of three judges was selected from the speech staff of the University of Virginia to evaluate the first and last speech of all groups. A seven point rating scale devised for the experiment was used for the evaluating procedures. The method of analyzing the data was that of the analysis of variance, the basic variable being the mean rating of each student's first and last speech in relation to content, organization, style, delivery, and general effectiveness. At the conclusion of the experiment, students in the experimental sections were asked to evaluate their attitude toward the motion pictures used as supplementary instruction, and to rank the films viewed in the order of their effectiveness and interest.

Within the limits of the study, the results showed that the use of motion pictures as reinforcement of instruction, was not a significant factor in the improvement of speaking techniques in the beginning public speaking course. The analysis of variance was applied to content, organization, style, delivery, and general effectiveness, and no significant differences were found in any of the above factors. An analysis of the mean differences of the control group and the experimental groups offered no evidence that motion pictures contributed to the improvement of student speakers, for Experimental Group I ranked second in style and third in organization, delivery, and general effectiveness, while Experimental Group II ranked second in content and third in style. Although Experimental Group I

ranked first in content and Experimental Group II ranked first in organization, delivery, and general effectiveness, the difference in ranking was not statistically significant. However, the results of the data from the attitude scale administered to the experimental groups indicated that students themselves believed that motion pictures were a helpful teaching device.

Microfilm $2.00; Xerox $5.40. 110 pages.

THE ROLE OF CRAFT IN BASIC EDUCATION IN INDIA

(L. C. Card No. Mic 58-5211)

Arvind Kumar Parikh, Ed.D.
Indiana University, 1958

"Basic Education" scheme is a scheme of education that puts great emphasis on instruction in craft. The scheme which was originated with Mohandas K. Gandhi, the great Indian leader, in 1938, has changed a great deal through years. The scheme in its present form contains a number of inconsistencies.

The main inconsistencies found in the scheme are as follows: (1) inconsistency in interpretation of concepts, such as "activity," (2) inconsistency in the basic philosophy and syllabi and methods suggested in the Handbook for Teachers of Basic Schools, published by the Ministry of Education, Government of India, (3) inconsistency in the emphasis on vocational objective, (4) inconsistency in the concept of correlation, and (5) inconsistency in the choice of crafts.

Main causes of these inconsistencies are found to be (1) unwillingness to depart from the two ideas embodied in the original scheme of Gandhi: education through craft, and self-supporting education, (2) efforts to reconcile the Gandhian philosophy with that of the Western educators by making different interpretations of both--the Gandhian concept and Western educational concepts, (3) efforts to reinterpret the original scheme to suit the changed values, objectives and aspirations of the country, (4) lack of communication between Basic educators, and (5) indecisive character of the thinking of the Basic educators.

It is recommended that a clear exposition of a consistent philosophy of Basic Education should be available in printed form, and it should be followed by all Basic educators. Decisions should be made as to whether the craft instruction is meant for vocational training; whether the craft is to be made the core of curriculum or whether it should be used in projects or units; and whether the village-craft is for rural schools or whether it is to be introduced in urban schools also are to be made. Besides these specific recommendations a general recommendation of an objective review of the whole scheme, in the light of the new educational knowledge and the changing needs and aspirations of the country has been made.

Microfilm $2.00; Xerox $6.40. 135 pages.

A STUDY TO DETERMINE THE CONCEPTS OF PROGRESSIVE EDUCATION HELD BY SELECTED SCHOOL PATRONS AND SCHOOL STAFF MEMBERS

(L. C. Card No. Mic 59-137)

Carl Norman Schroeder, Ed.D.
Cornell University, 1958

Chairman: Lloyd H. Elliott

The most criticized educational philosophy today is Progressive Education. Apparently the ambiguity inherent in the term itself has inspired many critics to challenge many of the present day educational programs. Thus, educators need to discover the exact concepts of the term Progressive Education, as held by school patrons and school staff members. It is this problem with which this particular study was concerned.

Two identifical questionnaires were used to gather the data for this study. The groups involved were the school patrons with children in the elementary grades, and the professional school staff members in one city of approximately 20,000 population in central New York. A total of 1082 school patrons and 144 school staff members responded, for an average of eighty-six percent and ninety-four percent respectively. The questionnaires divided the total concept of Progressive Education into four areas: (1) Discipline in the schools; (2) Teacher aims and goals; (3) The role of the teacher in the classroom; and (4) Reporting of pupil progress. In each area the respondents were given the choice of three statements of concept, ranging from the traditional to the more progressive philosophy.

From comparisons made within the groups, and between the groups, with the use of the chi square method, it was found that:

1. Differences in concepts were present within each group, but the greatest differences were among the school patrons.
2. The majority of school patrons held liberal concepts of Progressive Education in the area of discipline, teacher aims, and reporting of pupil progress.
3. The majority of school patrons held eclectic concepts in the area of Progressive Education related to the role of the teacher in the classroom.
4. The male school patrons above thirty-five years of age, who earned below $5000 a year, and were either unskilled or semi-skilled, with a formal education not above the tenth grade, were more conservative in their concepts of Progressive Education than any other school patrons in terms of sex, age, income, occupation, or formal education.
5. The majority of the school staff members held liberal concepts of Progressive Education in all four of the defined areas.
6. A higher proportion of staff members held conservative concepts of Progressive Education in the area related to the role of the teacher in the classroom than in any of the other three defined areas.
7. The school staff members who were male and over thirty-five years of age, and had a liberal arts training, tended to have more conservative concepts of Progressive Education than any other staff members in terms of age, income, years of service, years of preparation, or other classified characteristics.
8. A higher proportion of school patrons held conservative concepts of Progressive Education than did staff members in the areas of discipline, teacher aims, and the role of the teacher in the classroom.

9. In both groups, the conservative concepts of Progressive Education were held by the highest proportion in the area related to the role of the teachers in the classroom.

10. A high proportion of both school patrons and school staff members held liberal concepts of Progressive Education in the area related to the reporting of pupil progress.

Microfilm $4.05; Xerox $13.60. 315 pages.

PRAGMATISM AND THE CONCEPT OF FREEDOM IN THE WRITINGS OF BOYD H. BODE, WILLIAM H. KILPATRICK, AND MAX C. OTTO

(L. C. Card No. Mic 59-429)

Intissar Abdelal Younis Taha, Ph.D.
The Ohio State University, 1958

The pragmatic point of view finds its grounding in the continuous interaction between the organism and its environment. The pragmatists put their faith in the ability of human intelligence to shape life. Their philosophy rejects absolutes and fixed standards. It emphasizes the operational character of concepts and the evolving nature of truth.

In this study three contemporary educational philosophers who have sought to render pragmatic views applicable to the concept of freedom have been selected. These are Boyd H. Bode, William H. Kilpatrick, and Max C. Otto.

The three believe that by placing their faith in human intelligence as instrumentally conceived they provide for human freedom. They hold that man can maintain his freedom through the exercise of intelligence. Intelligence is operationally conceived and is honored in the measure that it proves itself capable of formulating concepts as tools for the furthering and the redefining of human purposes. For them, old values, standards, and truths are proximate and not absolute. Truth is determined not in terms of its genesis but in terms of its reliability when tested in human experience. A basic assumption behind this concept of freedom is that all existence is in a continuous process of change and interaction.

When freedom is conceived as the exercise of intelligence, it becomes a process of growth. So understood, the pragmatists believe that the main avenue for achieving it is education. Education should make its proper function the provisions for the continuous development of intelligence. It should develop attitudes of critical and creative thinking in the student to the end that he does not merely absorb the cultural heritage but continuously re-examines and re-evaluates it.

The pragmatic view of freedom has the intent of assuring to man his active part in shaping his life and improving his lot. It also makes man responsible for his actions and his behavior.

The difficulty that this view encounters is that unless it is reinforced by a moral theory that can be effectively put into practice the exercise of intelligence in itself can easily transform democracy into an intellectual aristocracy.

Microfilm $3.15; Xerox $10.80. 241 pages.

THE RELATIONSHIP OF PRIMARY MENTAL ABILITIES TO READING AND SPELLING ACHIEVEMENT OF PHONETICALLY DEFICIENT FOURTH GRADE STUDENTS WITH NORMAL OR HIGH INTELLIGENCE

(L. C. Card No. Mic 59-65)

Richard Carlton Wilson, Ph.D.
The University of North Carolina, 1958

Supervisor: Carl F. Brown

It was the purpose of this study to determine the relative influence of specific primary mental abilities upon the reading and spelling achievement of seventy-four phonetically deficient fourth grade boys and girls in the Raleigh, North Carolina, public schools.

The McKee Inventory Test of Phonetic Skills was used to determine phonetic deficiency. Reading and spelling achievement scores were taken from the Durrell-Sullivan Reading Achievement Test, Form A. Primary mental abilities were measured by the Science Research Associates Primary Mental Abilities Test, Form AH. Other information was obtained from school records, school administrators, supervisors, and teachers.

Statistical correlations were computed between scores on nine measures of primary mental ability and word meaning achievement, paragraph meaning achievement, total reading achievement, and spelling achievement scores.

The following conclusions were made from this study:

1. The degree of relatedness between measures of the primary mental abilities and measures of reading and spelling achievement vary from high to negligible.

2. The highest relationships exist between measures of primary mental ability involving the use of words and measures of reading and spelling achievement.

3. Phonetically deficient students with high verbal ability and/or word grouping ability should be expected to read well without the help of extensive phonetic word attack skills.

4. Students with low verbal and word grouping ability have a greater handicap in reading and spelling than students with relatively high verbal and word grouping ability.

5. Phonetically deficient children seem to read better than they spell.

6. Except for the primary mental abilities dependent upon the use of words for measurement, perception appears to be more important in gaining word meaning and in total reading achievement than any other single measure of primary mental ability. Space concepts seem to be more important to the students in this study in gaining paragraph meaning.

7. It is possible for a child with normal intellectual capacity who is deficient in phonetic knowledge to read and spell better than his grade norm.

8. Raleigh fourth grade students have acquired a knowledge of most of the phonetic elements usually taught in the primary grades.

9. The median grade equivalent of scores of all tests of reading and spelling achievement are above the test norm for all boys and girls of equal grade placement.

10. In this study phonetically deficient white children with normal intelligence tended to read and spell better than the Negro children.

11. White students made their poorest scores in spelling and word meaning achievement.
12. Negro students made their poorest scores in total reading and word meaning achievement.

Recommendations were made based on the conclusions reached in the study.

Microfilm $2.05; Xerox $7.40. 156 pages.

A SURVEY AND ANALYSIS OF THE ROLE OF GENERAL SECONDARY SCHOOL SUPERVISORS

(L. C. Card No. Mic 59-436)

Norman Ziff, Ph.D.
The Ohio State University, 1958

A survey and analysis of the role of the general secondary school supervisor was undertaken in view of the relative newness of the position of general supervisor at the staff level of school districts.

The hypotheses studied were (1) that there is a determinable pattern of operations among general supervisors judged to be successful and (2) that this pattern of operations is consistent with modern supervision theory and practice as described in the literature. In addition, the experiential background of general secondary school supervisors was explored, the organizational framework within which these supervisors work was discussed, and their thinking about certain problems and issues of supervision was revealed.

Two hundred and forty names and addresses of general supervisors were suggested by forty-two state superintendents of public instruction and twenty-six state presidents of the Association for Supervision and Curriculum Development. A questionnaire was sent to each one of these 240 supervisors.

The questionnaire consisted of a Personal Data Sheet and three divisions: Division I, Check List of Supervisory Activities, Division II, Organization of Supervisory Services, and Division III, Problems and Issues of Supervision. The purpose of the responses to the "Personal Data Sheet was to obtain a composite picture of the experiential background of effective supervisors. Responses to the Check List of Supervisory Activities were treated to obtain data relevant to the two hypotheses. Responses to the Organization of Supervisory Services were used to describe the organizational framework within which general supervisors work. The responses to the third and last section of the questionnaire revealed the opinions of general secondary school supervisors to certain problems and issues of supervision.

Of the 240 questionnaires sent, 158 were returned. Only fifty-six, however, met all the criteria identifying these supervisors as general secondary school supervisors. The remaining 102 questionnaires were processed, and the data were placed in the Appendix for the perusal of other investigators.

The responses of the fifty-six supervisors to the Check List of Supervisory Services were grouped and assigned numerical values. The eighty-three items representing supervisory duties, responsibilities, and competencies were then ranked according to total weighted scores under the headings, Importance of Activity to supervision and Degree of Accomplishment. In addition, the Spearman Rank Order Method of Correlation was used so that coefficients of correlation between the responses under the two headings could be derived.

The findings of this study led to these conclusions: (1) There is a determinable pattern of operations among general supervisors judged to be successful. (2) This pattern of operations is consistent with modern supervision theory and practice. (3) There is a high correlation between those supervisory activities designated as important to supervision and the stated degree of accomplishment. (4) The ratio of supervisors to teachers is too high. (5) General supervisors operate within a line and staff organization and perform staff functions. (6) These general supervisors are confused about their role as researchers in the evaluative process.

Microfilm $3.25; Xerox $11.00. 250 pages.

ENGINEERING, AGRICULTURAL

TURBO-GASIFIER AND AIR INDUCTOR FOR CROP DRYING

(L. C. Card No. Mic 59-1134)

Donnell Ray Hunt, Ph.D.
Iowa State College, 1958

Supervisors: Kenneth K. Barnes and Glenn Murphy

The use of a low output gas turbine, called a gasifier, and an inductor was investigated for possible application as a high-capacity, heated- air, crop drier.

The continuity equation, general energy equation, momentum equation and the perfect gas laws were used to derive an equation of eight variables relating inductor entrance and outlet conditions. These variables were also related to the primary-final weight rate of flow ratio.

Development of a gasifier was accomplished by adding a stainless steel combustion chamber to a turbo-supercharger. The exhaust chamber of the supercharger was sealed and fitted with a nozzle that terminated in the inlet of the inductor's mixing tube. Cranking power requirements were such that a farm tractor was required for starting the gasifier.

Assigning typical output values for farm crop driers to the inductor equations led to the establishment of optimum inductor inlet pressure and outlet velocity values of 2110 pounds per square foot and 100 feet per second respectively. A plot of the variables at these optimum pressure and velocity values was made to relate required gasifier output to desired inductor output.

Tests were run to evaluate the use of the theoretical analysis for the inductor action. Because of limited gasifier output, only a few tests were run at low inductor outlet static pressures. The length of time for conducting individual tests was limited by the overheating characteristics of the gasifier.

Test results indicated close agreement between the derived equations and measured values.

It was concluded that the gasifier-inductor configuration is feasible as a crop drier. More development work is required for a satisfactory, inexpensive, and reliable gasifier. Microfilm $2.00; Xerox $4.60. 90 pages.

ENGINEERING, AERONAUTICAL

EFFECTS OF CONTROLLED ELEMENT ON THE HUMAN PILOT

(L. C. Card No. Mic 58-7846)

Ian Albert Moore Hall, Ph.D.
Princeton University, 1957

A simulator study of the human pilot performing a two dimensional tracking task, with random excitation, is presented. The investigation is directed chiefly toward studying the effects on the pilot of various longitudinal controlled element dynamic characteristics, in particular those similar to conventional aircraft dynamics.

Several aspects of the pilot are examined. A technique for representing the pilot's response mathematically is presented, and the describing function and remnant term involved in this representation are obtained for a wide range of controlled elements. At the same time pilot opinion of the controlled elements' handling qualities are recorded, and for the more aircraft-like configurations this is explained in terms of the mathematical description. Tracking performance and average stick force are examined also, and a discussion is presented of the interactions of these various measurements, and how they add to the overall understanding of the pilot. In the light of these a method for synthesizing pilot opinion is suggested.

The mathematical representations are studied and the parts fitted by simple analytical models in order to present detailed changes in these as a result of changes in various controlled element parameters, and particular discussion is given of the physical meaningfulness of these observed changes. Certain probability measurements are presented and are used to validate the assumption that the measured describing functions are indeed Gaussian input describing functions.

The study shows how, in the plane of short period frequency and damping, distinct regions appear in which the describing function form remains the same. These include a lead-lag form for conventional dynamics, and development of double lead for some marginally stable configurations. Evidence is presented of two distinct sources of remnant, one originating from interaction with the lateral tracking loop, and the other the result of quite nonlinear behaviour, observed with certain extreme configurations. Consistent physical explanations of these remnant terms and of the changes in describing function are presented, and found helpful in understanding pilot opinions. Similarities between the results of this study, and previous work are presented, and in particular the similarity between pilot opinion data from this investigation and those obtained by Cornell Aeronautical Laboratory in a flight study is pointed out.

The investigation is of an exploratory nature, but indicates where more comprehensive study is required in order to supply quantitative design information to the aircraft designer. Microfilm $2.75; Xerox $9.60. 211 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

THE LAMINAR BOUNDARY-LAYER FLOW ON ROTATING CYLINDERS

(L. C. Card No. Mic 59-131)

Shao-Wen Liu, Ph.D.
Cornell University, 1958

The boundary-layer equations for a cylindrical blade rotating with a constant angular speed about an axis perpendicular to the cylindrical axis are re-examined, and from the existing solutions for rotating blades an extension is made to allow the axis of rotation to be arbitrarily located with respect to the leading edge of the blade.

The first part of this thesis deals with the case of a flat plate with the axis of rotation perpendicular to the plane of the plate. Two parameters are used to construct the boundary-layer flow at various locations on the plate with respect to the location of the axis of rotation. A perturbation procedure is set up by expressing the velocity components in series expansions in terms of the parameters. Successive orders in the velocity components are obtained by numerical integration.

The results show that the development of the boundary layer from the leading edge, as indicated by the relative deviation of any particular streamline from the potential streamline, is apparently unaffected by the location of the axis of rotation. Comparison with earlier first-order calculations is limited to cases where there is no eccentricity of the axis of rotation. Such first-order results are shown to give good approximations in regions where chordwise distance is much less than spanwise distance ($x/y << 1$). The streamlines of the boundary layer so calculated have smaller curvature than the more exact solutions which include higher-order terms.

The second part deals with cylinders with small thickness. The cylindrical symmetry is represented by assuming a universal velocity polynomial for the chordwise potential flow. As before, solution is obtained by means of series expansions in terms of appropriate parameters, as well as series expansion in terms of the chordwise coordinate. The perturbation due to small local taper of the cylinder is also included.

The deviations of the results from the infinite-cylinder flow are found to be mainly caused by the modification of the outstanding pressure-gradient terms. Such effects on the chordwise flow can be favorable or adverse, depending on the location of the axis of rotation. For example, when the axis is well behind the leading edge, the pressure gradient may become so unfavorable as to cause reversal of the chordwise flow component very near the leading edge; this is interpreted to mean leading-edge separation. The correction due to taper is again found to be small.

Microfilm $2.25; Xerox $7.80. 169 pages.

THE THREE-DIMENSIONAL FLOW FIELD OF AN AXIAL COMPRESSOR BLADE ROW - SUBSONIC, TRANSONIC, AND SUPERSONIC

(L. C. Card No. Mic 59-450)

James Elliott McCune, Ph.D.
Cornell University, 1958

A linear small-perturbation theory for the description of the steady-state flow field associated with an axial compressor blade row is developed by superposition of cylindrical wave functions. The method is valid for both subsonic and supersonic axial Mach numbers, and for thin, but otherwise arbitrary, blade geometries. In particular it is applicable to the transonic compressor, operating with relative Mach numbers that are subsonic at the hub and near sonic or supersonic at the tips.

The general formulae are applicable to all shrouded axial devices, whether of high or low solidity, but special attention is given to configurations with a large number of blades. Since the periodicity in the circumferential direction determines the order of the radial functions, advantage is taken of the large number of blades through the exploitation of the asymptotic formulae for Bessel functions of large order. In the subsonic and supersonic cases this makes possible the derivation of three-dimensional corrections to the classical cascade approximations. This technique also brings to light a useful similarity parameter that correlates the three-dimensional correction fields when the blade number is sufficiently large.

The method can be used, with only slight modification, to treat lifting as well as non-lifting configurations, but for purposes of simplicity in its development, the present study has been limited to consideration of the non-lifting, or thickness, problem. Numerical examples of the wave drag and pressure distributions associated with a blade row having twisted blades of radially decreasing thickness-to-chord ratio, and simple profiles are presented at several subsonic, transonic, and supersonic Mach numbers. Three-dimensional subsonic and supersonic pressure distributions are obtained by computing three-dimensional corrections to the classical cascade strip theories. In both the subsonic and supersonic regimes these corrections can be correlated using the similarity parameter mentioned above and are proportional to the inverse two-thirds power of the blade number.

Several examples of the pressure distrubutions in the transonic regime are also presented and discussed. The results obtained emphasize the breakdown of the two-dimensional (strip-theory) approximation in transonic flow and further demonstrate a smooth transition, within the linear theory, from the subsonic to the transonic regime. Even so, an acoustic resonance appears within the theory in the transonic, mixed-flow case. This phenomenon is treated here by including a small but finite viscous damping in the field, and this method succeeds in bringing the resonant condition within the scope of the linear theory, except possibly in one or two isolated cases. The nonlinearities associated with these isolated cases remain to be studied.

The numerical computations turn out to be practical in all cases. A brief outline is given of the modifications necessary to handle the lifting case with distributed loadings. In addition, other areas requiring further research are indicated. Microfilm $3.35; Xerox $11.40. 257 pages.

ON TRANSONIC FLOW ABOUT SLENDER THREE-DIMENSIONAL BODIES

(L. C. Card No. Mic 58-7669)

Hans Jakob Ulrich Thommen, Ph.D.
Brown University, 1958

The nonlinear differential equation for the perturbation potential of transonic flow about slender three-dimensional bodies is transformed into a nonlinear integral equation by means of multiple Fourier transforms. Two parameters are introduced and an attempt is made to choose these parameters locally, such that the nonlinear integral equation can be approximated by a linear one. Two different methods of choosing the parameters are investigated, varying either one or both parameters.

The approximate linear integral equation is of the type of conventional linear perturbation theory, but the kernel function is different. It contains, however, the kernel functions of linear subsonic and supersonic theory as special cases, i.e. for special values of the parameters.

The integral equation is solved for slender bodies of revolution at small angles of attack. The method is applied to a half body of revolution at zero incidence with parabolic nose section. The numerical evaluation has been carried out on a IBM 650 Electronic Computer and it was found, that the iteration process converges for almost all points and both methods of choosing the parameters.

Pressure distributions have been measured on a family of three half bodies of revolution with parabolic nose section. The tests were carried out for Mach numbers from 0.50 to 0.90 in steps of one tenth and from 0.95 to 1.05 in steps of 0.025. Additional tests for a Mach number of 1.10 are incomplete due to the power limitations of the auxiliary suction equipment. All tests were performed using two different wall configurations for the top and bottom walls:

a. Longitudinally slotted walls, 18.75% open.
b. Perforated walls, 22% open.

The agreement of the measurements for the different walls is in general good.

Comparison of the experimental results with the theoretical predictions indicates, that the method is suited in its present form only for supersonic free stream (two variable parameters) and for Mach numbers below the critical (one variable parameter). For supercritical but subsonic free stream both methods fail in the region, where in the physical space the flow is locally supersonic. This can probably be explained by the fact that reflection of signals on the sonic surface has been neglected in the present analysis. Microfilm $2.00; Xerox $6.80. 141 pages.

ENGINEERING, CHEMICAL

PULSE COLUMN DESIGN

(L. C. Card No. Mic 59-1128)

Lawrence Edward Burkhart, Ph.D.
Iowa State College, 1958

Supervisor: R. W. Fahien

A theoretical analysis of the pulse column was made using a stagewise approach to the problem. The column was assumed to be divided into discrete stages, each stage having been defined as that part of the column between two adjacent perforated plates. The cyclic reversal of flow which is characteristic of the pulse column permitted more material balance equations to be written than for a simple countercurrent extractor.

The operation of the pulse column was described mathematically using material balance equations and, from the theory developed, a design method was derived which used two "stage" lines and two "operating" lines, one set for the upstroke and one set for the downstroke of the pulse generator. The stages could be stepped off between each of these sets of lines in much the same manner as is done on a McCabe-Thiele diagram. Assuming equilibrium contact, the effect of recycle in a pulse column was shown to cause a large decrease in the separation obtained as the pulse frequency was increased. To account for non-equilibrium contact two stage efficiencies were defined, one for the upstroke and one for the downstroke half-cycle.

Hold-up studies were made using two systems, isoamyl alcohol - water and methyl isobutyl ketone - water. Under proper operating conditions the hold-up, per cycle, of the dispersed phase for both systems was shown to be equal to the interstage flow, per cycle, of the dispersed phase. The stagewise hold-up per cycle first decreased then increased as the pulse frequency was increased. With the water phase discontinuous a sharp increase in the dispersed phase hold-up was observed at critical pulse frequencies for the isoamyl alcohol - water system. The critical frequency was a function of the superficial flow rate of the dispersed phase. Hold-up behavior at high frequencies was quite different for the two systems.

Extraction runs were made using the system methyl isobutyl ketone-acetic acid - water. It was shown both theoretically and experimentally that even though the stage efficiencies may increase, the over-all separation performed by the column may decrease with increased pulse frequency because of the effect of recycle. The stage efficiencies were lower for that half-cycle in which the wetting fluid passed through the plates.

It was found to be theoretically possible for a column to be operating in a pinched-in region even though this would not be apparent from the superficial flow rate ratio of the feed streams. The change in the phase composition would change the actual interstage flow ratio between the stages and thus alter the slopes of the over-all stage line and the over-all operating line.

Sampling techniques were developed to take samples of the interstage flow streams in a column operating in the mixer-settler region. Removal of the sample from the column during the desired part of the pulse cycle was controlled by microswitches which operated specially constructed solenoid valves in the sampling lines.

Microfilm $2.00; Xerox $6.20. 126 pages.

THE CONDENSATION OF VAPORS FROM NONCONDENSING GASES

(L. C. Card No. Mic 59-130)

Lloyd James Kusak, Ph.D.
Cornell University, 1958

This study was undertaken to evaluate the Colburn-Hougen method of condenser design for systems consisting of a condensable vapor and a noncondensable gas and, if possible, to devise a simpler design method when the gas-vapor mixture is in laminar flow. Recent work by H. T. Robson indicated that when the gas-vapor stream is in laminar flow, the Colburn-Hougen method overdesigns condensers by as much as one hundred per cent. Furthermore, Robson's vertical condenser was more effective when the vapor entered at the top and left at the bottom (downflow) than when it entered at the bottom and left at the top of the condenser (upflow).

Methanol was condensed out of a methanol-and-air mixture in a set of vertically mounted condensers. A total of one hundred and eight runs was made. The Reynolds numbers of the gas-vapor stream at the inlet varied from 768 to 7670; the mol per cent of the air at the inlet varied from 13.9 to 75.3 per cent. A few runs were also made to study the condensation rates of a pure vapor; the inlet Reynolds numbers of these ranged from 1362 to 7377.

In 48 of the runs, the gas-vapor stream entered at the top and in the other 60 it entered at the bottom of the condenser. The condensers used were of three lengths and three diameters; these were, respectively, 4 inches, 12 inches and 24 inches and 1/2 inch, 1 inch and 1 1/2 inches. The inlet temperature of the cooling water was closely controlled at 25.0°C. The observations taken were those of condensing rates, rates of flow of the gas and vapor streams, and temperatures of the gas-vapor stream at the inlet and at the outlet of the condenser, of the condensate as it left the condenser and as it entered the collector, and of the exit gas.

The condenser areas were calculated for a few runs by the Colburn-Hougen method on the basis of the conditions within the condenser. In situations where the mol concentration of the air changed by more than 10 per cent the method tended to overdesign the condenser; this overdesign was as much as 100 per cent when the change in air concentration was very large.

Two empirical correlations, one for downflow and one for upflow were obtained by the method of least squares. These were:

Downflow: $$h_a\left(\frac{Ld}{Re}\right)^{1/3} = 7.12\, e^{-2.796 M_A}$$

Upflow: $$h_a\left(\frac{Ld}{Re}\right)^{1/3} \quad 7.55\, e^{-3.072 M_A}$$

where h_a = a fictitious gas-film conductance including all the conductances between the bulk of the gas and the surface of the condensate at a point L feet from the inlet of the condenser, Pcu/(hr)(ft.^{2})(°C).

L = length of condenser, feet.

d = diameter of condenser, feet.

$Re = \frac{dG}{u}$

G = mass velocity, lb./(hr.)(ft.^{2})

u = viscosity, lb./(hr.)(ft.)

M_A = mol fraction of air in the gas-vapor stream.

A statistical test established that the air-film conductance in downflow was greater than that in upflow. The difference is postulated to be due to eddies or convection currents that are set up in the gas-vapor stream because of density differences and these increase the heat transfer rate. If, in downflow condensation, the denser part of the stream were at the center, the velocity distribution would tend to increase the rotating speed of the eddy and hence more heat would be transferred. If the same system were in upflow condensation, the denser part of the stream would still be at the center, but the velocity distribution would be in the opposite direction and reduce the speed of the eddy. Hence, less heat would be transferred.

A general equation for the gas-film coefficient in downflow was obtained from the data of Schubert and Griswold. It is:

$$\frac{h_a}{D^{1/2}}\left(\frac{Ld}{Re}\right)^{1/3} = 7.25\, e^{-2.687 M_A}$$

where: D = gas-vapor diffusion coefficient, ft.^{2}/hr.

The equation was obtained from data in the streamline and transition regions and should not be used where the Reynolds exceeds 10,000. It is also limited to a range of 0.10 to 0.80 mol fraction of air.

The equation represents data with a cooling water temperature of 25.0°C. To correct for other cooling water temperatures, the following equation is suggested:

$$h_a = h_{a(25.0)}\left(\frac{t_v - 25.0}{t_v - t_w}\right)^{1/3}$$

where t_v = bulk temperature of the gas-vapor stream, °C.

t_w = temperature of the cooling water, °C.

The logarithmic mean of $U\Delta t$ at the inlet and at the outlet of the condenser is a good estimate of the integrated average $U\Delta t$ where

U = over-all conductance, Pcu/(hr.)(ft.^{2})(°C)

$\Delta t = t_v - t_w$, °C.

Where the cooling water temperature does not rise more than 10°C, this mean can be used to approximate condenser sizes. Microfilm $2.05; Xerox $7.20. 153 pages.

CONTINUOUS NITRATION OF BENZENE IN A ROTATING DIFFERENTIAL REACTOR

(L. C. Card No. Mic 59-453)

Jesse Sommers Tarleton, Ph.D.
Cornell University, 1958

The purpose of this work was twofold: 1) to design, construct, and evaluate a differential reactor suitable for

the mixed acid nitration of aromatic hydrocarbons, and 2) to use this reactor to make a kinetic study of initial rates of benzene nitration. Major emphasis was given to the first of these goals.

The reactor was designed to give high shear rates and short residence times, and to eliminate diffusion-controlled reaction. It consisted of two horizontal circular stainless steel plates, an upper stationary plate - the stator - and a lower rotating plate - the rotor - with a small, adjustable clearance between them. Benzene and acid feed streams flowed by gravity into the center of the space between the plates where they mixed and reacted. The reaction mixture was thrown by centrifugal force into a centrifugal separator where the two streams were separated and subsequently collected. Provision was made to measure and control the temperature in the reaction zone.

Acid of the same composition - 50 percent sulfuric acid, 24 percent nitric acid, and 26 percent water - was used for all runs. Most runs were made at the same temperature of 24°C. Three rotor speeds were used: 350, 630, and 1010 rpm. The distance between rotor and stator was varied from 0.002 to 0.030 inches. The feed rates and ratio of feed rates were also varied.

Satisfactory reaction-rate data were not obtained. There were two major difficulties: 1) diffusion was apparently not eliminated as the rate-controlling step, even at the smallest rotor-to-stator distance, and 2) the amount of reaction occurring in the centrifugal separator was much greater than that in the reactor zone, making it impossible to measure accurately the extent of reaction in the reactor zone. Removing the separator and quenching the reaction mixture in water did not help; in fact, splashing of the mixture in the collector ring made the problem worse.

Limited data indicated that overall conversion was proportional to the volume percentage of the acid phase in the feed. Temperature profiles across the reaction zone showed that, at rotor speeds of 630 rpm and over, the outer part of the reaction zone was not completely full of liquid. From the temperature rise when no cooling water was used, rough estimates of reaction rates were calculated. They ranged between 54 and 158 gram-moles per hour per liter of reactor volume. For comparison rates were also calculated from two published correlations of benzene nitrations for the reaction conditions used in these runs. They were computed to be 6.75 and 554 gram-moles per hour per liter. The reactor system was not completely enclosed and there was some loss of the feed liquid, probably because of evaporation of benzene in the collector ring. This loss was directly proportional to rotor speed.

It was concluded that this reactor was not suitable for the study of the nitration of benzene by mixed acid.

Microfilm $2.45; Xerox $8.60. 187 pages.

DESULFURIZATION OF GYPSUM

(L. C. Card No. Mic 59-1152)

Thomas David Wheelock, Ph.D.
Iowa State College, 1958

Supervisor: D. R. Boylan

The thermodynamic and kinetic feasibility of decomposing gypsum into sulfur dioxide and calcium oxide by application of heat alone (thermal decomposition) and by application of heat and a reducing gas (reductive decomposition) was investigated. The purpose was to determine whether thermal or reductive decomposition could be used for a commercial process.

Examination of the reaction equilibria showed that reductive decomposition was thermodynamically feasible but thermal decomposition was questionable. On the other hand, the kinetic feasibility of reductive decomposition was uncertain because of side reactions which could lead to the formation of calcium sulfide.

In a laboratory study samples of crushed and sized gypsum were heated in a controlled atmosphere while suspended from a weighing balance. When a nitrogen atmosphere was employed, the gypsum decomposed fairly rapidly at temperatures in the range of 2200 to 2300°F. However, the presence of small amounts of the decomposition products, sulfur dioxide and oxygen, in the atmosphere either prevented the decomposition or reduced the rate of decomposition to a negligible value. Hence thermal decomposition is considered impractical.

When a reducing gas such as carbon monoxide was mixed with carbon dioxide, sulfur dioxide, and nitrogen and then passed over gypsum heated to about 2200°F, the decomposition was generally rapid. The rate of decomposition was found to be a function of the temperature, mass velocity, particle size and gas composition. It was also shown that the amount of calcium sulfide formed was a function of the temperature and gas composition. Conditions were determined which would yield almost complete desulfurization, a relatively fast rate of decomposition, and a negligible amount of calcium sulfide. Thus when a gas mixture composed of 4 per cent carbon monoxide, 20 per cent carbon dioxide, 5 per cent sulfur dioxide, and 71 per cent nitrogen was passed over -7 +8 mesh particles of gypsum at 2200°F, the desulfurization was rapid and complete and the amount of calcium sulfide produced was negligible. Hence it is concluded that reductive decomposition is feasible.

In order to demonstrate one type of process based on reductive decomposition a pilot plant scale shaft furnace was built and operated in a semicontinuous manner. During the most successful period of operation gypsum was introduced at a rate of 12 pounds per hour and 89 per cent desulfurization occurred. An off-gas containing 2.8 per cent sulfurous gases, believed to be principally sulfur dioxide, was produced along with by-product lime containing 3.1 per cent calcium sulfide. Although these results did not appear economically attractive, further improvement seemed possible since the optimum conditions of operation were not determined.

Microfilm $3.30; Xerox $11.20. 254 pages.

ENGINEERING, CIVIL

STABILIZATION OF IOWA SOILS WITH CUTBACK ASPHALT

(L. C. Card No. Mic 58-7560)

Ramanath Keshavarao Katti, Ph.D.
Iowa State College, 1958

Supervisor: D. T. Davidson

Two processes have been investigated to determine what moisture controls should be exercised during mixing and during compaction of soil-cutback asphalt mixtures to ensure a stabilized material having an optimum combination of properties. The stabilized mixes were evaluated on the basis of the Iowa Bearing Value strength, the dry density, the absorption, the expansion and the total moisture content after 7 days soaking. One sandy, two silty, one clayey soil, MC-2 and MC-4 cutback asphalts were used in this investigation.

Prior to the main investigation several sub-studies were conducted to develop instruments and to establish a uniform procedure for testing. The sub-studies were: a comparison of testing methods, the Iowa Bearing Value test, the determination of immersion time, mixing cutback asphalt, soil and water, and the simultaneous determination of hydrocarbon volatile materials and water.

In Process I the water content was varied during mixing and all other variables were kept constant. The soil-asphalt mixture was compacted with a water content equal to that used in mixing. The specimens were immersed in distilled water for seven days immediately after compaction and were then subjected to the IBV test. The previously mentioned properties were determined to evaluate the mixes.

It was noted that the mixing moisture content required to obtain an optimum value was different for each property. The Compromise Moisture Content (CMC) was determined, and it represents the moisture content during mixing which produces the best combination of all properties considered. The CMC was determined by the method of first powers with equal weight to all the properties. It was found that the CMC was close to the mixing moisture content that produced the maximum compacted standard Proctor dry density of the silty or the clayey soil cutback asphalt mixtures.

In Process II the water content during mixing was sufficient to ensure good cutback asphalt distribution; mixtures were dried back before compaction. The results were evaluated by an analysis similar to that used in Process I. The data indicate that Process I produced superior specimens as compared with those produced by Process II.

The relationship of the distribution of cutback asphalt in soil to the amount of mixing water was studied by comparing photographs of cross sections of compacted soil-water-cutback asphalt mixtures. The distribution of cutback asphalt improved as the amounts of mixing moisture increased and reached a quasi-homogeneous mix near the liquid limit of the soil. Little or no moisture content was needed to distribute MC-2 cutback asphalt in sand, however, for MC-4 cutback asphalt some moisture was needed.

The results were in general agreement with the theory of Benson and Becker. The maximum stability of soil-cutback asphalt mixtures was obtained by using a moisture content in the mixing that produced maximum compacted densities. Microfilm $2.00; Xerox $6.80. 142 pages.

ENGINEERING, ELECTRICAL

APPLICATION OF "COMPARISON OF EXPERIMENTS" TO RADAR DETECTION AND CODING PROBLEMS

(L. C. Card No. Mic 59-247)

Norman Manuel Abramson, Ph.D.
Stanford University, 1958

"Comparison of Experiments" is the name given to a recently developed topic in statistical decision theory. It deals not with the making of decisions but with the data (or experiment) upon which the decision is based.

After a brief discussion of statistical decision theory and comparison of experiments in general, some practical methods are developed for comparing experiments with an infinite as well as a finite number of outcomes. Examples are then given of the application of these methods to radar detection and elementary binary coding.

In the radar case comparison of experiments amounts to comparison of the signals used to detect a target. This application may therefore be called comparison of radar signals. In the coding case the problem of signal repetition to provide reliability of data transmission is considered. The relationship between the number of repetitions and the probability of correct transmission of a single digit is investigated.

Microfilm $2.00; Xerox $4.80. 91 pages.

THE LINEAR LEAST SQUARES SYNTHESIS OF CONTINUOUS AND SAMPLED DATA MULTIVARIABLE SYSTEMS

(L. C. Card No. Mic 59-248)

Rosario Charles Amara, Ph.D.
Stanford University, 1958

The class of systems treated in this report is that characterized by a multiplicity of inputs and outputs. For such linear multivariable systems subject to continuous and sampled stochastic inputs with arbitrary self- and cross-correlations, a derivation is made of the minimization equations to be satisfied by the optimum transfer-function matrix. The criterion of performance which is used is the minimization of the sum of the mean-square errors between the set of actual outputs and a set of desired outputs. In each case the errors are evaluated at all instants of time.

The analysis divides the multivariable problem into two principal parts. In the first, designated the filter case, are included those systems in which the only restriction on the linear transfer-function matrix to be realized is that of physical realizability. Included in the second, the control case, are those systems in which a controlled matrix is specified which imposes additional restrictions on the overall performance of the system.

The results of the analysis are presented compactly in matrix form. Solutions to the minimization equations are obtained by the use of both explicit and implicit methods. A number of illustrative multivariable examples are presented which show that significant improvement may be obtained in minimum realizable error over the corresponding

single-variable solutions which are included as special cases. The cost of this improvement is generally in the form of more complex transfer functions.

Microfilm $2.00; Xerox $6.40. 135 pages.

DIGITAL ANALYSIS OF ELECTRICAL POWER SYSTEM TRANSIENTS

(L. C. Card No. Mic 59-115)

Newton Hall Barnette, Ph.D.
Cornell University, 1958

The transient stability of a multi-machine electrical power system is predicted by solving a set of simultaneous, non-linear, second order differential equations which describe the electro-mechanical oscillations of the machine rotors following a disturbance to the system. Prior to the advent of digital computers, the equations for small systems were solved by means of desk calculations while medium and large system solutions required the use of physical analogs, called network analysers. Now that computers are generally available and engineers are learning programming techniques, a number of applications are being made to the problems which are met in both small and large systems.

The recent technical literature contains accounts of successful applications of digital methods to several aspects of the classical problem of stability prediction for faulted power systems. These procedures have placed great emphasis upon the accommodation of large system sizes and the realization of high computation rates. As a result, the published techniques are ordinarily specialized in scope and function, not attempting to include a comprehensive analysis of the full problem. For example, system constants and initial system conditions are usually determined by assumption or by separate treatment as a special or auxiliary problem.

The subject dissertation subordinates considerations of system size and speed of computation. Emphasis is placed upon developing mathematical methods and interpretive digital programs which provide a unified and coherent solution of the several component parts of the stability problem. The mathematical discourse and the resulting programs provide a research tool for use with small systems (up to ten busses, with five machines) and constitute an academic treatise suitable for use in classroom instruction.

The order of discussion is as follows:

Introduction and mathematical statement of the stability problem.

Development, assembly, and organization of mathematical methods for the solution of the three major phases of the problem:

1) Initial system balance, including a special technique of iteration at machine terminals, with applications to the rapid synthesis of experimental systems and to the study of power interchange between generators.

2) Network reduction, with emphasis upon the network admittance matrix as a mathematical model of the power system network, and the development of methods for representing changes in network states by means of appropriate modifications of the mathematical model.

3) Swing equation solutions, with discussions of numerical integration methods.

Introduction to interpretive computer programming.

Development of complex arithmetic subroutines and an impedance inversion program.

Development and proof of an Initial Balance Program.

Development and proof of a Network Reduction Program.

Development and proof of a Swing Equation Program.

Presentation of three auxiliary programs which link the three major programs.

Presentation of all-digital studies of three illustrative power systems.

Description of a simultaneous test of several programs.

Correlation and critical comparison of network analyser studies of the three illustrative systems with the digital solutions.

Presentation of a suggested approach to the study of inertia effects upon power system transients.

Conclusion, with suggested applications and extensions. Microfilm $4.00; Xerox $13.60. 311 pages.

A STUDY OF THE ITERATIVE METHOD OF NETWORK SYNTHESIS

(L. C. Card No. Mic 59-252)

Chin-Yuan Chang, Ph.D.
Stanford University, 1958

This report is intended to introduce and demonstrate some properties of the iterative method of zero-pole network synthesis in the frequency domain, as well as to extend its applications. Maximally flat or equal ripple frequency response approximation is used in illustrations and applications. The philosophy of the iterative method consists of the choice of reasonable starting poles or zeros of a network function corresponding to a designated circuit configuration, and the repeated computation of zeros from poles and vice versa through the use of the realization and frequency response constraints, alternately, until it converges within the desired accuracy.

Some special outcomes of the iterative process in addition to its normal convergent results have been identified and are illustrated. A degeneration phenomenon makes some element values of the original circuit zero or infinity ultimately as the iteration progresses. An oscillation phenomenon does not yield convergent solutions (even if a solution exists) but poles and zeros of the network function oscillate between two different sets of points. A quasi-divergence phenomenon behaves like a random process and does not converge practically.

The last two phenomena justify a statement that the iterative method may not work even though a solution exists. A description of limitations of the iterative method, comparison of the equating-coefficient and Darlington's methods in the iterative computations, and a modified equation of iteration are given.

Linear-phase networks with equal ripple approximation utilizing all-pass transfer function are synthesized. Design charts for these all-pass transfer functions of lower orders are computed. Applications to the synthesis of two-channel amplifier circuits and three-terminal pair networks are illustrated. The possibility of solving a more general multiple-channel wideband amplifier circuit problem, to improve the gain-bandwidth-factor by the use of the iterative method is also described.

Microfilm $2.00; Xerox $5.00. 99 pages.

MODIFIED MULTIFILAR HELICES FOR USE IN WIDE-BAND TRAVELING-WAVE TUBES

(L. C. Card No. Mic 59-262)

Daniel Gould Dow, Ph.D.
Stanford University, 1958

This study has demonstrated the practical utilization of a modified multifilar helix as the slow-wave circuit in a traveling-wave amplifier. The advantages of the multifilar helix are principally the increased beam interaction impedance which is available and the capability for wideband forward-wave amplification at large values of ka, the normalized diameter-to-wavelength ratio. With a simple multifilar helix, operation at large ka is prohibited by the presence of the so-called antisymmetric mode which can generate backward-wave oscillations when the helix is used in an attempt to obtain forward-wave amplification in the symmetric mode. If this antisymmetric mode can be suppressed, the above mentioned advantages of the multifilar helix are available. This study has been concerned principally with the bifilar helix, although the concepts and methods of analysis can be extended to larger numbers of wires in a straightforward manner.

A method of strapping the bifilar helix with rods directly through the center has been developed. This form of strapping allows separate control over the properties of the electric and magnetic fields of the two modes. The exact center of the rods carries a maximum of current but has no axial electric field in the antisymmetric mode, while it has a maximum of electric field but no current flow in the symmetric mode. Using these properties, slow-wave circuits with mode-selective loss and mode-selective stop bands have been designed and constructed with the objective of eliminating the backward-wave oscillation in the antisymmetric mode while affecting only slightly the desirable forward-wave properties of the symmetric mode. A typical circuit has a stop band in the antisymmetric mode 50% wide in frequency, a forward-wave bandwidth of almost two to one, and impedance about two-thirds that of a simple bifilar helix operated in the same mode.

In addition to extensive theoretical calculations and cold-circuit measurements, two models of an experimental traveling-wave tube have been constructed and operated in good agreement with the theoretical expectations.

Microfilm $2.00; Xerox $6.00. 123 pages.

A STUDY OF AVALANCHE TRANSISTORS

(L. C. Card No. Mic 59-267)

Donald Shepard Gage, Ph.D.
Stanford University, 1958

When a reverse bias is applied to a p-n junction, the region near the junction is essentially depleted of mobile charge carriers. Any mobile charge carriers that are present in this depleted region will drift in the electric field associated with the reverse bias. As the reverse bias is increased, the depleted region expands. In addition, a higher electric field increases the energy acquired by a mobile charge carrier in a free path. If the magnitude of the electric field becomes sufficient, some of the charge carriers gain sufficient energy to ionize the valence electrons of the semiconductor atoms by collision, a process called avalanche multiplication. When one of the two junctions in an ordinary transistor is sufficiently reverse biased, the depleted region expands to include all of the base region, a condition called voltage punch through. In certain transistors, the electric field at voltage punch through is sufficient simultaneously to result in some avalanche multiplication. The principal aim of this study has been a better understanding of avalanche transistors.

In this study of avalanche transistors the simultaneous occurrence of avalanche multiplication and voltage punch through was discovered to produce either large current pulses or pulses with a very fast rise time. As examples, circuits are given in which small transistors with performance ordinarily limited to low frequencies (1) carry a current pulse of 18 amperes or (2) operate with a rise time of 4×10^{-9} sec. An analysis of this mode of operation is given which includes some quantitative results and a description of the regenerative mechanism.

In order quantitatively to analyze circuits which utilize avalanche multiplication and voltage punch through, it is necessary to approximate the avalanche transistor by a model. The distributed system of the transistor can be approximated by a lumped model. The lumped model represents the flow of holes and electrons by drift and diffusion, the p-n junction relationships, the displacement currents, and avalanche multiplication within the transistor. Several of the equations derived from the lumped model are nonlinear, and this suggests the use of finite-difference techniques to effect the quantitative analysis. The form of the resulting finite-difference equations does not permit their numerical solution to be usable unless the time interval in each step-by-step calculation is small. An example is given in which this short time interval results in not only a lengthy computation, but also poor numerical accuracy. By modifying the finite-difference equations, the limit on the time interval can be removed. Yet there is no mathematical assurance that the modified finite-difference equations will yield a numerical solution that converges to the true differential solution of the lumped model.

In the multiplication phenomenon, a consideration of the space charge of the conducting carriers in the depleted region is shown to account qualitatively for the dependence, which has previously been observed but not explained, of avalanche multiplication upon voltage and current.

Useful circuits are given for measuring the voltage at which punch through occurs, the breakdown voltage, and the voltage at which the current gain of the transistor is unity. These high-voltage parameters of the transistor are shown to permit the calculation for an alloy transistor of

the base width, the base resistivity, the depletion-region width, and the multiplication.

Microfilm $2.00; Xerox $6.40. 133 pages.

AIRCRAFT DETECTION BY DOPPLER INTERFERENCE AT VHF

(L. C. Card No. Mic 59-162)

Wesley Bert Henry, Ph.D.
The University of Texas, 1958

Supervisor: Dr. A. W. Straiton

This report describes a system for detecting aircraft presence by the Doppler interference to UHF and VHF signals from commercial radio or TV stations caused by the reflected signals from aircraft. The particular case considered in this report consists of an elevated transmitter and essentially ground level receiver separated by 50 to 100 miles. This system emphasizes the detection in the area of the receiver as compared with systems which emphasize different detection areas. A theoretical treatment of the problem is presented along with experimental data taken at several different detection sites.

Microfilm $2.00; Xerox $4.60. 89 pages.

SEMICONDUCTOR COMPARATOR CIRCUITS

(L. C. Card No. Mic 59-269)

Gustave Leo Hoehn, Jr., Ph.D.
Stanford University, 1958

The comparison operation can be defined mathematically as the indication of time instants when the amplitude of an input function is equal to the amplitude of some reference function. The ideal comparator that will perform such an operation is not realizable with the expenditure of a finite power. An actual circuit will possess errors in its measurement of amplitude and/or its indication of time because of noise and drift effects.

Comparison can only be defined for a finite field of measurement consisting of a prescribed range of time and amplitudes. A certain minimum power is required to meet given specifications on the field and accuracy of comparison; the circuit requiring no greater power is an optimum comparator and is the best realizable circuit.

Comparison is a nonlinear operation and a criterion is presented to indicate the degree of nonlinearity, or sharpness, of comparators. This sharpness criterion reveals definite advantages in the use of semiconductor diodes rather than thermionic diodes in comparator circuits. The same criterion indicates that regenerative circuits should perform comparison better than non-regenerative circuits.

Specific regenerative comparator circuits employing semiconductor diodes are studied and analyzed. Linear analysis reveals certain criteria useful in minimizing comparison errors due to temperature variations. Also linear analysis is found useful in the study of the limits imposed upon comparator accuracy by circuit noise. Nonlinear analysis is a necessary method for studying the transition region between stability and instability in regenerative circuits.

Experimental studies substantiate the usefulness of temperature compensation techniques and the limit to which they may be carried. Measurements made at a constant temperature clearly indicate that noise within the comparator circuit limits the precision with which comparison can be effected.

Microfilm $2.00; Xerox $4.80. 95 pages.

LOBE-SWEEPING ARRAYS FOR THE DETECTION OF RADIO SIGNALS OF EXTRATERRESTRIAL ORIGIN

(L. C. Card No. Mic 59-388)

Wen Chung Hung, Ph.D.
The Ohio State University, 1958

In the dissertation the properties of lobe-sweeping antennas for radio astronomy applications are studied theoretically and experimentally. A main objective is the investigation of their properties and a consideration of means for their useful characteristics. The theoretical approach treats a narrow beam antenna scanning over a field containing, in three separate cases respectively, a fixed point source, a moving point source, and a pulsating point source. The theoretical treatment also includes the properties of a rotating helix array and a traveling wave antenna as lobe-sweeping antennas. A graphical method of solution for the output signal of a lobe-sweeping antenna is presented for the three types of source variations. The analytic solution for the optimum beam width to sweep angle ratio is found to be approximately one-third. The problems of a pulsating source and the applications of monopulse techniques are also discussed.

Experimentally measured patterns of arrays of three and five helices are presented. The effect of an axial central conductor on the helix pattern is also investigated by means of pattern measurements on helices with and without the axial conductor. The measurements showed that an axial central conducting support for a helical antenna does not appreciably affect the pattern of the helix unless the support is near an odd multiple of a quarter wavelength.

Extensive tests were made on a lobe-sweeping end-fed traveling wave antenna operating on 27 mc/s. Lobe-sweeping was produced by the insertion of adjustable phase shifting coils at quarter wave intervals along the wire. Calculated antenna patterns are also presented. The lobe structure of the traveling wave lobe-sweeping antenna appears to be satisfactory, and it is possible to obtain a 20 degree sweep angle before excessive standing waves appear. Measurements of the galactic radiation background with this antenna confirmed the pattern characteristics.

Microfilm $2.00; Xerox $4.80. 91 pages.

SLALOM INJECTION FOR THE HELITRON OSCILLATOR

(L. C. Card No. Mic 59-270)

James Lloyd Jones, Ph.D.
Stanford University, 1958

This study is concerned with a new type of electron beam injection for the helitron oscillator. The helitron, which was invented in 1954 by D. A. Watkins, is a voltage-tuned, backward-wave oscillator in which focusing of the electron beam depends upon a balance between centrifugal force of helical motion and a radial electrostatic field. The new injection mechanism is called slalom injection since the beam is first launched into a path like that of Slalom-Focusing and then injected from the slalom path into the concentric-cylinder geometry of the helitron.

The design of a new electron gun to produce a convergent strip beam is discussed in some detail. This gun employs a novel construction of the beam-forming electrode, the shape of which was determined by an approximate analytic method. Calculations giving the theoretical beam-spreading curve outside the anode are included. Construction of the electron gun is described and the results of a test to determine the beam transmission and the shape of the beam are reported. Beam transmission was approximately 95 per cent out of the gun, although the shape of the beam and the minimum thickness were not entirely satisfactory.

A physical description of the slalom injection scheme is given, followed by a detailed discussion of electron-trajectory computations. These trajectory computations, which neglect space-charge forces, were made numerically on the IBM 650 computer, using potential data measured on a two-dimensional model of the structure painted on Teledeltos paper.

Finally, the experimental program to study this type of beam injection is discussed. A description of an experimental beam-tester tube is given, followed by a report of the results obtained with this device. Beam transmission of 40 per cent of cathode current to the collector was obtained, and a variation of 20 per cent to 40 per cent transmission over a simulated tuning range of 2 to 1 in frequency was measured.

Microfilm $2.00; Xerox $4.20. 80 pages.

AN ANALYSIS OF NONLINEAR SAMPLED-DATA CONTROL SYSTEMS

(L. C. Card No. Mic 58-7981)

Edwin Kinnen, Ph.D.
Purdue University, 1958

Major Professor: Julius Tou

Methods of numerical analysis are often used in nonlinear control system transient analysis when the familiar describing function method and phase plane method are inadequate. The results obtained from a numerical analysis are usually an approximation to the solution. This is caused by the finite interval of time which is used to establish the series of points representing the approximating solution.

The research reported in this thesis investigates the use of numerical analysis methods for obtaining exact transient response solutions of nonlinear sampled-data control systems. To simplify the application of the resulting methods, maximum use is made of existing information on z-transformation theory and notation, and of readily available z-transform tables. Although the results are easily adapted to machine programming, the specific intent of these developments is to provide a practical procedure not dependent on a machine solution.

An expression is developed which, by repetitive application, easily permits the sampled error values of a nonlinear sampled-data system to be found. The response to any specified input disturbance can be computed. The step, impulse and ramp functions, however, have simplifying advantages. Initially the system nonlinearity is placed between the error sampler function and the frequency sensitive portion of the control system. The nonlinearity modifies only the pulse amplitude of the sampler output. This leads to a closed-loop expression containing power series in the z domain. The coefficients of the power series provide a set of equations with one unknown sampled error value in each equation. If a unit step input disturbance is considered, these resulting equations are

$$E_{k+1} = E_k - \sum_{n=0}^{k} a_n N\left[E_{k-n}\right].$$

E_k is the sampled error value at t=kT and $N\left[E_{k-n}\right]$ is the nonlinear amplitude function of the magnitude, E_{k-n}.

The term a_n in the above equation is the difference between two consecutive terms of the z^{-1} expansion of the linear portion of the system.

$$a_n = g_{n+1} - g_n$$

g_n can be found from a z-transformation table and an algebraic division. Although a_n belongs to an infinite series, the terms of the series usually approach zero rapidly as n increases. N can be represented graphically or analytically, or as a computer program. The graphical representation is particularly suitable for abrupt or complex nonlinearities.

Relatively simple modifications allow this method to be applied to systems with a multivalued nonlinearity or a transport delay. Intersample evaluations are possible by the use of the modified z-transformation.

A second result follows from an investigation of a system containing a nonlinearity between two frequency sensitive transfer functions. The exact transient solution for this system configuration is no longer possible but an approximation can provide an adequate solution.

The description of the nonlinearity is limited to the establishment of a unique output for any given input condition; the degree of complication involved in the description of the nonlinearity has little influence on the work of applying the methods. Furthermore, the order of the system is not limited, and the applications are not made appreciably more difficult by increasing the order of the system.

Cumulative errors plague most numerical methods. This is also true for these methods. However, experimental checks on numerical examples indicate that acceptable accuracies can result if reasonable care is exercised in the computational work.

For the symmetrical nonlinearity of a contactor with an output ± 1 or 0, the numerical methods establish

conditions and limitations on the step function response characteristics. These results can aid in the design of a digital filter to be used with the nonlinearity, or in the design of the complete system which will contain the nonlinearity. Microfilm $2.00; Xerox $5.60. 111 pages.

ECONOMIC POWER SYSTEM LOADING

(L. C. Card No. Mic 59-1138)

John Emil Lagerstrom, Ph.D.
Iowa State College, 1958

Supervisor: W. B. Boast

The basic problem of economic power system loading is to determine a combination of outputs from several electric generators which will result in the minimum total fuel input to the system. The fuel input required by the various plants in a system will be different, depending upon the type of fuel burned, the delivered cost of this fuel, and the efficiency with which each plant utilizes its fuel. Plants which are electrically close together should operate at the same incremental rate ξ for minimum input, where ξ is defined as the slope of the fuel input vs. power output characteristic. Plants which are separated by an electric network should not operate at this equal incremental rate condition due to the cost of the losses encountered in interchanging power among plants. In general, a plant electrically remote from a load area will be penalized by transmission losses in favor of a plant located near the load center.

It is necessary to describe the electric network and the loads to be applied to the system. The network data must be reduced to a set of transfer impedance magnitudes B and impedance angles β. It is also necessary to describe the fuel input vs. generator output characteristics from which are derived the incremental rate curves for the various plants. The fuel data should be expressed by the best-fitting power series expansion giving plant input in monetary units as a function of generator output. Differentiation of this series will yield ξ.

The total system input can thus be expressed as a function of the voltage magnitudes E and the voltage phase angle differences δ throughout the system. The criteria for minimum input can be found by setting partial derivatives of the input with respect to the variables to zero. It must be assumed, however, that operating conditions will specify the voltages about the system. Thus the voltages are not variable in seeking the minimum input, and hence the problem reduces to finding the values of voltage phase angles which will make the partial derivatives of the input with respect to these angles zero. All of the terms in these derivatives are of the general form

$$X_{ji} = \xi_j \frac{E_j E_i}{B_{ji}} \sin (\beta_{ji} + \delta_{ji})$$

with the restriction that j can never be equal to i. If the total system input is denoted P_t, then the criteria may be summarized by

$$\frac{\partial P_t}{\partial \delta_j} = \sum_{\substack{i=1 \\ i \neq j}}^{n} (X_{ji} - X_{ij}) = 0.$$

The practical solution of these criteria is a series of trial solutions. For each trial a set of phase angles must be assumed. These, together with the prescribed voltages of the system, will specify the power flows and the generator outputs throughout the system. The incremental rates may then be determined and inserted in the criteria. Evaluation of the derivatives of P_t will reveal which of the angles should be changed for the next trial, and the sign of the derivative will indicate the direction of the change. The iteration should continue until a trial yields derivatives which indicate that the next change should be the opposite of the change last made.

Microfilm $2.00; Xerox $4.40. 82 pages.

AN APPLICATION OF THE THEORY OF GAMES TO RADAR RECEPTION PROBLEMS

(L. C. Card No. Mic 59-609)

Nils John Nilsson, Ph.D.
Stanford University, 1958

Radar reception in the presence of jamming noise contains the elements of a conflict situation and is therefore a problem in the theory of games. The radar operators are constrained to a certain average power, and a matched filter is to be the radar receiver. The design variable for the radar operators is the shape of the power spectral density function. The jammers, also, may choose a power spectral density function subject to an average power limitation. These spectral shapes comprise the strategies for both teams in a game. Various criteria of performance of the radar are determined by the spectral shapes chosen by each team. These criteria—the output signal-to-noise ratio, the mean square range error, and the mean square velocity error—are each, in turn, made the payoff function of the game. Analysis of each of these games reveals optimum spectral shapes from the point of view of both the jammers and the radar operators. When signal-to-noise ratio is the payoff function, constant-density, band-limited spectra are optimum for both teams. The optimum spectra associated with the other two payoff functions are discovered after finding a method to simplify the resulting games. Microfilm $2.00; Xerox $5.60. 115 pages.

DESIGN OF OPEN-ENDED RESONANT CAVITIES

(L. C. Card No. Mic 59-182)

Donald Childress Thorn, Ph.D.
The University of Texas, 1958

Supervisor: Dr. A. W. Straiton

This study deals with the design, construction, and testing of two types of resonant cavities operating near 9435 megacycles per second in which the end plates are replaced by terminations which leave the cross-sections of these cavities essentially unobstructed. A resonant cavity is considered, classically, to be a region containing a dielectric completely surrounded by some material with as high a conductivity as possible. Alternately, a cavity may

be thought of as a waveguide transmission line in which energy propagates until it strikes a termination, usually a solid conductor which serves as a short circuit. The energy reflected back then encounters a similar barrier. At resonance, the two barriers are separated by an integral number of half-wavelengths. In certain applications the presence of these solid conductors presents a serious problem. One type of cavity design is discussed which gives satisfactory electrical characteristics when the obstruction to flow through the cavity is removed so as to give very large openings (98.33% of the cross-section area).

The terminations used are so designed that they divide the waveguide which forms the body of the cavity into two or more smaller waveguides such that these smaller waveguides are "beyond cutoff" for the frequency of operation of the cavity. The characteristic impedance of a waveguide excited at a frequency lower than its lowest cutoff frequency is purely reactive. Thus energy in the body of the cavity encounters at the terminations a region of purely imaginary impedance. This results in total reflection if the waveguides are lossless. The design and testing of two cavities are reported. One of these is rectangular in cross-section while the other is cylindrical. Tests' results are given for the Q of these cavities, 3420 for the rectangular and 2310 for the cylindrical, and a presentation of variation of Q with length of termination sections is given for the rectangular cavity. A method of temperature compensation is proposed and tests' results are presented to establish that the method is sound.

Appendices are included which give a mathematical treatment of the cavities' fields, the applicability of "beyond cutoff" waveguides as a termination, establishment of "beyond cutoff" character of terminations used, and of the temperature compensation design.

Microfilm $2.00; Xerox $3.00. 53 pages.

EFFECTS OF TOPOGRAPHY AND REFRACTIVE INDEX ON LOW-ANGLE 3 CM RADIO WAVES

(L. C. Card No. Mic 59-183)

Hugh Theron Tomlinson, Ph.D.
The University of Texas, 1958

Supervisor: A. W. Straiton, Ph.D.

This dissertation describes a series of radio propagation tests and the analysis of the data obtained. The purpose of the tests was to study the effects of meteorological and terrain conditions on horizontally-radiated 3 CM radio waves.

Terrain effects were measured by recording field intensity patterns as a function of height, using the elevator of a 275 foot tower to carry the receiver.

Several transmission paths were used to determine the effect of different types of terrain. The magnitude of the field intensity changes indicated effective coefficients of reflection of 0.1 to 0.4 for both horizontal and vertical polarizations. One transmission path provided an excellent example of knife-edge diffraction.

Diurnal movements of height-gain patterns were effectively related to changes in the index of refraction of the transmission atmosphere. By using the differential change in average index of refraction for the direct and reflection paths, an agreement between calculated and measured direction of null movement was obtained in 29 out of 34 cases.

Microfilm $2.00; Xerox $5.80. 117 pages.

FADING AND ATTENUATION OF HIGH-FREQUENCY RADIO WAVES OVER A LONG PATH CROSSING THE AURORAL ZONE

(L. C. Card No. Mic 59-291)

Kung Chie Yeh, Ph.D.
Stanford University, 1958

This investigation is concerned with the fading and attenuation of high-frequency radio signals propagated over a long path crossing the auroral zone. The fading of high-frequency signals propagated over non-auroral paths of comparable length has also been studied, and some new results are presented.

The theory of radio wave fading and the methods of analyzing fading records are outlined and discussed. The presence of irregularities in the ionosphere introduces signal amplitude variations which are, in general, functions of time, space coordinates, and the radio frequency. A theory of selective fading is developed in terms of diffraction from an assumed one-dimensional screen of random irregularities. Dependence of selective fading on the angular power spectrum (defined as the power in a differential angular range) and the "size" of the irregularities is studied. Evidence is presented to show that signals reflected from auroral ionization have relatively high fading speeds. In addition, the frequency interval over which this fading is correlated is relatively small.

The principal fading and attenuation measurements on which these conclusions are based were carried out in August, 1957. Results are grouped in accordance with the propagation path involved: auroral, temperate latitude, and transequatorial. Special emphasis has been placed on the measurements of auroral paths. For this situation, there is no diurnal variation in fading speed except for a distinct minimum in the time interval 1300-1900 PST, during which the fading speed has no apparent dependence on magnetic activity along the path. In other periods a positive correlation between fading speed and magnetic activity is found. It is suggested that the afternoon minimum in fading speed is a consequence of the existence at that time of the kind of propagation mode made possible by ionospheric tilts.

Attenuation over the long auroral-zone path is found to be associated with "blackouts" as indicated by the absence of returned echo in vertical sounders located along the path. The percent association varies with the location of the station relative to the path, and the time of day. This is explained on the basis of certain assumed propagation modes. A positive correlation of auroral attenuation with magnetic activity is found for all the periods of the day.

Similar observations for temperate-latitude and transequatorial paths of comparable length indicate that there is strong diurnal variation in fading speed. Some plausible explanations are offered. In addition, a remarkably regular

fading was observed at times on transmissions from the BBC relay station at Singapore. It is believed to have a Doppler origin and is tentatively named "Doppler" fading.

Microfilm $2.00; Xerox $4.20. 78 pages.

ENGINEERING, MECHANICAL

LOCAL BOILING EFFECTS ON DENSITY AND PRESSURE DROP

(L. C. Card No. Mic 59-258)

Charles Pierce Costello, Ph.D.
Stanford University, 1958

In local boiling, a liquid which is below its saturation temperature is in contact with a heater surface above the liquid's boiling temperature. Tremendous increases in heat transfer coefficients are caused by bubble agitation at the heater surface. This prompts the use of local boiling in systems such as nuclear reactors and rocket engines in which large quantities of energy must be transferred with compact equipment and low temperature differences.

Local boiling causes a decrease in the average density of the coolant. Previous investigators have disclosed that in a channel in which local boiling is taking place, pressure fields differ substantially from those occurring in heat transfer without a change of phase.

Vapor bubbles on the heater surface are responsible for the reduction in average density and for the deviation of pressure fields from those of non-boiling fields. The bubbles grow on the heater surface and then condense in the liquid. On a time averaged basis, the bubbles constitute a layer of vapor on the heater surface, and the thickness of this layer determines coolant average density and, to some extent, pressure drop.

A test loop has been constructed which is of such dimensions that a beta particle emitter and a Geiger counter can be used to accurately determine vapor thickness during local boiling, Provision is also made to measure pressure along the heater length and to measure the temperatures required to evaluate heat transfer performance.

A semi-analytic method was devised to permit prediction of vapor thickness from photographic data, and the results of the analysis were compared to the experimental data of the present tests. It was found that the experimentally determined vapor thicknesses agreed well with those obtained by the semi-analytic method applied to photographic data. By the semi-analytic method

$$\text{Vapor thickness} = 0.67\ R_{eff} F$$

where

R_{eff} = average radius of vapor bubble during its lifetime

$$= \frac{1}{\theta} \int_o^{\theta} R(t)\ dt$$

$$= 100\ N\theta\ \frac{1}{\theta} \int_o^{\theta} \pi\ R(t)^2\ dt$$

θ is the bubble lifetime, N the bubble population bubbles/sec (sq in), and R(t) the bubble radius as a function of time. The values of θ, N and R(t) may be obtained from photographic studies.

Vapor thickness data may be used to determine density of the coolant in the flow channel from the relation

$$\rho_{avg} = \frac{A_l \rho_l}{A}$$

where

A = flow area of channel

ρ_l = density of liquid water

A_l = area occupied by liquid, i.e., the total channel area minus that occupied by vapor

The constriction of the flow channel by vapor necessitates acceleration of liquid to maintain continuity, and the system static pressure drop thus caused may be calculated from vapor thickness data.

Effects of the parameters heat flux, subcooling, and velocity on the vapor thickness are evaluated quantitatively. A quantitative discussion of the effects of the parameters on over-all pressure drop is presented. It is suggested that by proper system design, density variation and acceleration pressure drop can be minimized while retaining the advantageous effects of local boiling on heat transfer characteristics.

Microfilm $2.00; Xerox $5.80. 119 pages.

A STUDY OF ROTARY PNEUMATIC SERVOMECHANISMS

(L. C. Card No. Mic 59-370)

Ernest Otto Doebelin, Ph.D.
The Ohio State University, 1958

Control systems using fluid-power actuators have been used for a wide variety of practical applications. In the servomechanisms area, hydraulic systems have been used almost exclusively. Recently, pneumatic systems have become of interest because high operating temperatures in aircraft and missile applications limit the use of hydraulic components. Also, for industrial applications, pneumatic systems operating directly from factory air lines at 100 pounds per square inch air pressure may offer economic or performance advantages over hydraulic or electric systems for medium power requirements.

Linearized analyses of vane-type and axial-piston type air motors were carried out. The motors were driven by conventional four-way closed-center servovalves. Differential equations were derived, based on a simplified model of motor and valve action. Transfer functions relating motor rotation to valve opening were obtained and were combined with those for conventional motion transducers, servo amplifiers, and valve torque motors to give open and closed-loop transfer functions for complete rotary electro-pneumatic positional servomechanisms.

Tests were run on a system by using an axial-piston motor as the power element. These tests were mainly step displacement commands. Effects of size of step, system gain, valve dither and added pneumatic damping were studied. Because of large coulomb friction in the motor, performance was found to be better for large commands than for small. Increase in gain resulted in decrease in stability, but this could be partially offset by adding pneumatic damping. Valve dither decreased valve hysteresis but had little effect on overall system performance. Non-linear velocity and acceleration saturation effects were noted for large signals. Microfilm $2.00; Xerox $6.40. 131 pages.

ENGINEERING MECHANICS

DYNAMICS OF A FLY-BALL MOTION SENSING DEVICE

(L. C. Card No. Mic 59-1129)

Edwin Richard Chubbuck, Ph.D.
Iowa State College, 1958

Supervisor: Glenn Murphy

The use of a fly-ball device as an instrument for detecting and measuring angular motion was investigated. The proposed device would be similar to a fly-ball governor whose axis of spin is horizontal; whose spin speed is constant (K radians per sec.), and which would be subjected to angular motion $\omega(t)$ around a vertical axis passing through the point of attachment of the fly-ball arms. The angle (θ) between the axis of spin and either arm (length L) would be maintained the same for both arms by mechanical constraints. A torsion spring (of spring constant C) would be employed to return the two masses (each of mass m) toward the axis of spin.

A motion sensing device such as described herein could be used in missiles, aircraft, torpedoes, or other vehicles whose angular motion is to be controlled or recorded.

Frictionless operation and alignment with the direction of effective gravity of the axis of angular motion to be measured were two important assumptions.

Lagrange's equations were used to obtain the following differential equation of motion from the expression for kinetic energy:

$$\frac{d^2\theta}{dt^2} = 1/2 \left[K^2 - \omega^2(t)\mathrm{Cos}^2 Kt \right] \mathrm{Sin}2\theta - \frac{C}{2ML^2}\theta.$$

Very little progress was made in solving this non-linear differential equation of motion; therefore, computer methods were used.

One hundred and fifty specific problems were explored with an analog computer and twelve were solved with an IBM 650. The results obtained for θ as a function of time were oscillatory and irregular, but in general not periodic. Excellent agreement between the analog and digital results were obtained.

The problems solved in this thesis were actually the inverses of those that would be interesting in practice. Reasonable turning functions were assumed in the development in this work; then the action of the device was determined in terms of the angle (θ) between spin axis and either arm as a function of time. In a practical use of the instrument, $\theta(t)$ would be available by measurement and the angular motion of the vehicle carrying the instrument would be calculated from $\theta(t)$. This process was outlined.

The conclusions are that a fly-ball device such as the one proposed could well be used to detect and measure angular motion provided the instrument is designed and operated properly with relation to the magnitude of the turning velocity.

Microfilm $2.15; Xerox $7.60. 161 pages.

A STUDY OF THE THREE-DIMENSIONAL STRESS FUNCTIONS OF ELASTICITY WITH PARTICULAR APPLICATION TO THE RECTANGULAR BEAM

(L. C. Card No. Mic 59-396)

Arthur William Leissa, Ph.D.
The Ohio State University, 1958

The solution of any elasticity problem requires that three sets of necessary and sufficient conditions be satisfied -- the equilibrium, compatibility, and boundary conditions. The expression of these conditions generally takes the form of sets of non-linear, partial differential equations, which are formidable in appearance and extremely difficult to solve. Quite often, these equations are put into a more useful form by the use of a stress function approach, in which the stresses are defined in terms of certain undetermined functions. The solution of the problem then becomes that of finding the appropriate stress function. This approach has resulted in most of the known solutions to elasticity problems. However, these solutions have been generally limited to classes of problems which are either two-dimensional in nature or have some simplification in their geometry or loading.

Four types of three-dimensional stress functions have been formulated which are general in nature. In each of these approaches, the stresses are defined either directly or indirectly in terms of arbitrary functions. These four systems are (1) the Maxwell stress functions, (2) the Morera stress functions, (3) the Galerkin strain functions, and (4) the Papkovitch-Neuber displacement functions.

A further development of the Maxwell stress functions was presented by Langhaar and Stippes in 1954. They were able to achieve a means of defining the stresses in terms of harmonic functions so as to satisfy identically the three-dimensional equations of equilibrium and compatibility, leaving only the boundary conditions to be satisfied for the complete solution to any problem.

The author discusses the application of this development to the important class of problems involving the rectangular beam. One approach included involves the use of transcendental harmonic functions obtained from Laplace's equation by a separation of variables. The author was unable to obtain a workable technique for the solution of rectangular beam problems of a general nature because of the extreme complexity of the equations which express the boundary conditions. Solutions are readily obtainable, however, for a limited group of these problems having boundary conditions which are easily fitted by the transcendental functions.

The other approach discussed is that of using the harmonic polynomials. Two methods are considered which involve this approach. The first method consists of the superposition of solutions obtained from the harmonic polynomials by letting each coefficient, in turn, be the only non-zero one. This involves the use of a catalogue of solutions, such as the one given in an appendix of this work. Various examples are given in which these solutions are combined to give interesting results.

The more direct approach of problem solution is also presented, wherein the equations are written which express the restrictions imposed at the boundaries, and the coefficients are obtained by the simultaneous solution of a set of linear equations. Using this method, the problem of the rectangular cantilever beam subjected to a parabolically distributed shearing stress on the free end is discussed. It is seen that consideration of the polynomials through the fourth degree does not solve the problem, but does give the solutions to five other problems of a similar nature. The further extension to the sixth degree polynomial gives no further results for this particular problem. It remains to be seen whether the continuation to higher degrees, such as the eighth or tenth, will give the solution.

Microfilm $2.00; Xerox $5.80. 116 pages.

ENGINEERING, METALLURGY

PHASE STUDIES IN THE URANIUM-HAFNIUM SYSTEM

(L. C. Card No. Mic 59-1127)

Donald Joseph Beerntsen, Ph.D.
Iowa State College, 1958

Supervisor: David Peterson

The uranium-hafnium system has been investigated using metallography, thermal analysis, X-ray diffraction identification, melting point observations and electrical resistance measurements. Thermal analyses indicate that hafnium increases the temperature of the alpha-beta transformation on heating from 668°C. to about 676°C. Above this temperature the alpha uranium phase decomposes to beta uranium and alpha hafnium. The maximum solubility of hafnium in alpha uranium appears to be less than 0.25 atomic percent. The addition of hafnium to uranium lowers the beta to gamma transformation to an eutectoid at 733°C. and 4.5 atomic percent hafnium. Further cooling causes the gamma phase to decompose to beta uranium and alpha hafnium. The solubility of hafnium in beta uranium at the eutectoid temperature is less than 0.5 atomic percent.

Melting point data indicate that at elevated temperatures, the body-centered cubic modifications of uranium and hafnium are soluble in all proportions and exhibit neither a maximum nor a minimum in the solidus temperatures. Alloys containing 20-65 atomic percent hafnium quenched from 1100°C. and above contain a phase whose X-ray powder pattern is almost identical to that of the delta phase of the uranium-zirconium system. The lattice constants for the hexagonal delta phase in the 52 atomic percent hafnium alloy quenched from 1300°C. are a = 4.97 A. and c = 3.04 A. This phase is believed to be a metastable phase in the uranium-hafnium system which at equilibrium decomposes to alpha hafnium and uranium.

Metallographic and electrical resistance data indicate that uranium lowers the alpha-beta transformation in hafnium from about 1730°C. to a monotectoid at about 1150°C. and 55 atomic percent hafnium. Oxygen was found to have a very significant effect on the equilibria in uranium-hafnium alloys. Even very small amounts caused alpha hafnium to occur in alloys which, on a binary basis, should have been one phase body-centered cubic alloys.

At 1425°C. the solubility of uranium in hafnium is between 1.9 and 2.3 atomic percent. At temperatures below 1000°C. it was difficult to determine the solubility because of a considerable number of inclusions in the unalloyed hafnium metal. However, the solubility of uranium in hafnium at 650°C. was estimated to be less than 0.6 atomic percent.

Microfilm $2.00; Xerox $4.00. 74 pages.

THE KINETICS AND MECHANISM OF THE CONVERSION OF TITANIUM DIOXIDE TO TITANIUM NITRIDE

(L. C. Card No. Mic 59-371)

David Leslie Douglass, Ph.D.
The Ohio State University, 1958

The nitridization of TiO_2, Ti_2O_3, and TiO was studied in the temperature range 900°-1070°C. The change of weight of each substance with time followed a parabolic rate law.

Breaks were observed in the plots of the test for parabolic behavior at both 1010° and 1070°C, indicating either a change in mechanism or a complex system associated with conjugate layers. Activation energies of 76,000 and 91,000 calories were found for the short and long-time curves, respectively. These values were greater than the activation energy (53,000 cal.) for the diffusion of nitrogen in TiN. The parabolic rate constants for the three starting materials were in the ratio of

$$K_{Ti_2O_3} : K_{TiO_2} : K_{TiO} = 9000 : 3000 : 1.$$

The initial step in the reaction sequence was a rapid, partial dissociation of TiO_2 to $TiO_{1.95}$. The $TiO_{1.95}$ was subsequently reduced through Ti_9O_{17}, Ti_8O_{15}, Ti_7O_{13}, Ti_2O_3, to TiO. Nitride formation was observed only when TiO was present and adjacent to the nitride.

A small weight gain was observed during nitridization of TiO, and was ascribed to the solution of nitrogen into the numerous vacant oxygen sites of TiO which contained about 15 per cent vacancies. No change in lattice parameter was observed due to the solution of nitrogen in TiO to form an oxynitride; both TiN and TiO-substrate reflections were observed, corresponding to lattice parameters of 4.238 and 4.178 Å, respectively.

The slow rate constant of TiO was attributed to the absence of an electron source such as Ti_2O_3 which was present in the other starting materials. The electrons were necessary in order for both oxygen and nitrogen to enter the covalent-metallic TiO and TiN structures.

The pressure dependency of the rate constant, determined at 1010°C for TiO_2 between 0.032 and 1.0 atm. ammonia, was proportional to the 0.75 power of the ammonia pressure. The observed relationship was not due to a gas-solid interfacial reaction but was probably related to the pressure dependency of nitrogen and oxygen diffusion.

The formation of TiN was dependent upon the inward diffusion of nitrogen and the outward diffusion of oxygen.

Microfilm $2.00; Xerox $5.20. 103 pages.

I. ACTIVITIES OF IRON AND NICKEL IN LIQUID IRON-NICKEL SOLUTIONS. II. THE VAPOR PRESSURE OF IRON BETWEEN 1450°C AND 1530°C.

(L. C. Card No. Mic 59-390)

Alvin Joseph Jacobs, Ph.D.
The Ohio State University, 1958

The activities of nickel in liquid iron-nickel solutions containing from 10 to 90 atomic percent nickel were measured over the temperature range 1510°C. to 1600°C. A special function was employed whereby activities can be computed by a graphical integration using the results of chemical analyses on the vapor phase alone. The liquid solutions studied exhibit negative deviation from Raoult's law, but they approach ideality as the temperature is raised from 1510°C. to 1600°C. The maximum heat of solution is less than -8.0 kcal./mole. The entropy of solution is less than -2.5 cal./mole deg. at 1510°C. and changes negligibly as the temperature is raised. The liquid iron-nickel solutions do not follow regular solution behavior.

The Knudsen method was employed to measure the vapor pressure of iron between 1450°C. and 1530°C. The values found satisfy the straight line, $\log_{10} P(\text{atm.}) = \frac{19703}{T} + 6.2608$. The mean heat of sublimation of iron at $0^{\circ}K$, ΔH^{0}_{o}, is 99,969 $\pm$ 422 cal./mole. Vapor pressure and heat values agree very closely with data obtained on γ-iron by means of the Langmuir method, thereby indicating an accommodation coefficient of unity for iron.

Microfilm $2.00; Xerox $3.00. 53 pages.

BACHIACCA STUDIES: THE USES OF IMITATION

(L. C. Card No. Mic 58-7869)

Howard Sutermeister Merritt, Ph.D.
Princeton University, 1958

The thesis is based on the supposition that a detailed analysis of selected works by Francesco Ubertini, called Bachiacca, is of value in the general study of early Tuscan mannerism. An exact contemporary of Pontormo, Bachiacca was first a pupil of Perugino and then active in Florence from about 1514, mainly on small commissions. Not a major or inventive artist, he was, rather, an ingenious compiler, constructing apparently original works through the use of paintings, drawings, and prints by others. In important instances the elements he has thus taken over can be shown to cast light on lost or controversial works by important masters, including Perugino, Fra Bartolommeo, Leonardo, Pontormo, Michelangelo.

Bachiacca's works are used herein to demonstrate the close and fruitful interrelationship between painting and prints that is one of the most pervasive and, perhaps, causative features of mannerist painting. It is shown that he draws freely, but not haphazardly, from prints by Durer, Lucas van Leyden, Marcantonio Raimondi, Agostino Veneziano, and Marco Dente.

Following brief reviews of the known documentary evidence, the evidence from Vasari, and modern criticism of Bachiacca, his early chronology is established by internal evidence from the paintings, especially those of the Camera Borgherini, around which are then grouped various early works. Virtually all of the paintings after 1515 prove to be artificial constructions, wittily and knowingly compiled, far removed from High Renaissance standards in conception and execution. It is suggested that his method is a definite forerunner of a systematic eclectic program, made possible by existence of the reproductive print, using mainly Italian sources for figures and northern sources for landscape, and frequently combining different sources in one figure.

The Camaldoli commission of 1521 and the Benintendi commission of 1523 are discussed, consideration of the former having one result in the renaming and re-evaluation of an important Pontormo. The Conversion of St. Paul is analyzed at length as an important document in confirming the accuracy of the Holkham Hall copy of Michelangelo's Battle of Cascina. The Gathering of Manna and the late Martyrs of Mt. Ararat, among others, are also analyzed in detail to clarify Bachiacca's method and sources.

No support of theory is adduced for this eclectic method. It appears to have developed empirically as a personal solution to the almost intolerable problem facing the minor artist of his time. Trained in a style already academicizing, he did not mature in contact with the High Renaissance - as did Pontormo and Rosso - but adapted, rather, to the changed conditions in Florence by a selective and absorptive process of imitation; a borrowing of motives, attitudes, technical procedures, which is to a remarkable extent concealed within a witty, small scale and decorative manner. This suggests that, some ten or fifteen years earlier than Bronzino, Bachiacca already foreshadows a sort of "mannered mannerism", and in his methods anticipates those of Vasari's generation. At the same time he remains securely linked to the Quattrocento, not merely

through training and lingering use of motives and compositional habits, but also through being the most important continuer, within the mannerist period, of the older cassoni painting tradition.

It is concluded that Bachiacca's eclecticism can be turned from an aesthetic fault into an art historical virtue, in the light it throws not only on the work of others but on the methods of one of the most important lesser painters of the time. The thesis as a whole suggests that a real understanding of both early and academic mannerism will not come without a thorough assessment of the role of the print in their development. Toward such a study the works of Bachiacca point the way.

Microfilm $2.15; Xerox $7.60. 162 pages.

JEAN LE TAVERNIER OF AUDENARDE [AND] ILLUSTRATIONS (VOLUMES I-VII)

(L. C. Card No. Mic 58-5847)

Earl Mueller, Ph.D.
State University of Iowa, 1958

Chairman: Professor Lester D. Longman

The study of Jean le Tavernier, master decorator and illustrator of books, proposes to form a vita of the artist by interpretation of established and equivocal data, and to establish a stylistic chronology and working catalogue for further attributions from the complete presentation of his alleged work. To the 104 pages of text are appended ten pages of bibliography, a table of Tavernier data, a summary of Tavernier attributions, a thirty-five page descriptive catalogue, and seven volumes of 414 miniatures in photographic reproduction.

An illegitimate member of an Audenarde family of artisans, Tavernier is identified as a Tournai master decorator, active 1434-40. Documentation for his work as an illustrator derives from the short period, 1450-1460, when his atelier was established at Audenarde (Belgium) and where he produced important work for Miélot and Aubert, editors of Philip the Good, Duke of Burgundy. A Tavernier, active in Bruges, 1450-1480, is denied identity with the Tournai-Audenarde Tavernier on grounds of guild control of the book crafts in Bruges during those years.

Tavernier's style appears to be derived, iconographically, from the Tournai school of panel painting; narratively, from anonymous north French illuminators of the 1440's; and decoratively, from the Audenarde tapestry production for which illustrators provided designs. He disappeared shortly after 1460, leaving no "school" and no imitators.

The Tavernier oeuvre is developed from one documented work, the Croniques et Conquestes de Charlemaine, Brussels, Bibliothèque Royale, MSS 9066-68. An interpretation of the evidence of the prologue, colophon, payment notice, and iconography of the presentation miniature establishes a division and progression of his late style. A partially documented portion of the so-called Prayer Book of Philip the Good, the Hague, Royal Library, MS 76 F 2, provides an early terminal, 1454, for style as well as examples of the Tavernier calligraphy in letter decoration. Two volumes of Miracles de Notre Dame, Paris, Bibl. Nat., MS fr. 9198, and Oxford, Bodleian Library, MS Douce 374, bridge stylistically the intervening years, 1456-58. These are all in grisaille; for a color hypothesis of Tavernier's work, the Cité de Dieu, vol. II, Strasbourg, University Library, MS 523, is invoked as an early example, related to the Hague Prayer Book by style and by matching, calligraphic letter decoration.

Against the core of manuscripts which reveal Tavernier's idioms and mastery of the grisaille style, and the Strasbourg prediction for second-rate color production, the remainder of the manuscript attributions are measured. Seven grisaille miniatures in the Paris, Bibl. Nat., MS fr. 6275 are accepted; Brussels, Bibl. Royale MSS 9278-80 and 9092, a Mondovi Missal, and Paris, Bibl. Nat., MS fr. 9087 are questioned; Brussels, MSS 9095, 11129, and 10308, Lyon, MS 517, and Vienna, MS 1857 are eliminated; attributions in Paris, Bibl. Nat., MS fr. 9199 and Brussels, Bibl. Royale, MS 9511 are kept outside the Tavernier catalogue as post-Tavernier copy, and influential prototype, respectively.

In the final analysis, Tavernier, in his mannered and archaic style, is revealed as an artistic complement to the fashion, protocol, and decadent chivalry of the epoch of Philip the Good of Burgundy.

Microfilm $7.35; Xerox $25.40. 579 pages.

DOMENICO VENEZIANO STUDIES

(L. C. Card No. Mic 58-7258)

Hellmut Wohl, Ph.D.
New York University, 1958

Adviser: Professor Craig H. Smyth

The most extensive attempt to date to construct an integrated picture of Domenico Veneziano's art, this dissertation consists primarily of detailed stylistic and iconographic investigations of the artist's twelve undisputed autograph works. The major problems of Domenico Veneziano scholarship are the origins and development of his style, and its status in Florentine and Italian painting. Since none of the autograph works are dated, and hardly any documents survive testifying to Domenico's career, these questions depend for their solution almost exclusively on the internal evidence of his paintings.

The first of seven chapters deals with the S. Lucia Altar, seeking to articulate, by means of a close formal analysis, the characteristics of Domenico's style. Its connection with Florentine art is stressed. This is followed by a chapter on the five predella panels of this altarpiece, including an attempt to establish their chronological order during the decade of the 1440's. The Carnesecchi Tabernacle, since it is Domenico's only other signed work beside the S. Lucia Altar, is discussed next. An attempt has been made to reconstruct its original appearance and to place it in the decade preceding the S. Lucia Altar. The fourth chapter concerns the fresco in S. Croce and suggests a reconstruction of its original location, partly on the basis of sixteenth-century sources and partly from physical evidence revealed when the fresco was recently detached. It is interpreted as an example of Domenico's

late style in the 1450's. In chapter five the three Madonna panels (in the Berenson Collection, Washington and Bucharest) are taken up, leaving the Berlin Adoration of the Magi, Domenico's most problematical picture in regard to its place in his development, as the last of his undisputed works to be discussed. A date close to 1460 is suggested for this work, on the basis of its style as well as its connections with other Florentine works of this period. In chapter seven two new attributions are suggested, datable in the pre-Florentine phase of Domenico's career. These become the basis for the hypothesis that Domenico's painterly use of light and color in the spatial and decorative organization of his compositions has its origins in Northern Italy. In the conclusion, which follows, an attempt is made to give an account of Domenico's stylistic development as it emerges from the preceding studies.

In a series of seven appendices the first discusses briefly four of the recent inadmissable attributions to Domenico (which, since the nineteenth century, number seventy). Appendix two deals with the S. Egidio frescoes, taking into account the recently discovered fragments. The remaining appendices contain an examination of the evidence for Domenico's lost works and a transcription, with some commentary, of the documents and sources relating to his life, art and fame.

In the image of Domenico Veneziano's art that emerges from these studies particular emphasis is given to his anticipation of and, to some extent, possible influence on formal developments leading ultimately to the High Renaissance, particularly in regard to the integration of an architectural and at the same time rhythmic formation of figures, through plastically charged line, with a construction of space not only through linear perspective but also through light and color. The content of Domenico's pictures, showing a profound concern for religious as well as humanistic values and emotions, is stressed. Attention is also given to Domenico's role as an innovator of compositions, postures and facial types conveying dramatic action with both physical and psychological lucidity and concentration. Finally, the relationship of Domenico Veneziano to Alberti is suggested as significant in evaluating his art.

Microfilm $6.80; Xerox $24.00. 534 pages.

THE INHIBITION, PROPERTIES AND PURIFICATION OF PANCREATIC CHOLESTEROL ESTERASE

(L. C. Card No. Mic 58-5471)

Howard Abraham Ira Newman, Ph.D.
University of Illinois, 1958

Chick, pork and human cholesterol esterases were found to be competitively inhibited by 1 mg./ml. Quillaja saponin when various concentrations of cholesteryl acetate were used as a substrate, and rates of ester hydrolysis were assayed by potentiometric titration. However, the cholesterol esterase in chick pancreas demonstrated an anomaly in the Lineweaver-Burk curve at high substrate concentrat. ons. Digitonin (1×10^{-4} M) also demonstrated inhibition of pork pancreatic cholesterol esterase. To correlate these results with cholesterol absorption, four-week-old male chicks (New Hampshire ♂ x Columbian ♀) were fed, ad libitum, for two weeks a natural grain diet supplemented factorially with cholesterol and Baker saponin. The serum and livers were analyzed for cholesterol content by adaptations of the Sperry-Schoenheimer technique. The results showed that when saponin was fed with cholesterol, liver cholesterol was depressed to about one-half the level found in livers of birds fed only cholesterol. However, there was no comparable reduction in serum cholesterol levels. Fecal cholesterol determinations showed that the cholesterol excreted by the cholesterol-fed birds was less than half the level excreted by birds fed both cholesterol and saponin. In another study, one-week-old male chicks (New Hampshire ♂ x Columbian ♀) were individually and equally fed a synthetic diet supplemented factorially with cholesterol and Quillaja saponin for a 2-week experimental period. The serum and livers of the chicks were analyzed for cholesterol content by the Sperry-Schoenheimer technique. The results showed that when saponin and cholesterol were fed together, liver cholesterol levels were depressed more than 100 mg.%, a depression significant at better than the 1% probability level. An analysis of the serum of birds fed both saponin and cholesterol showed no corresponding depression of cholesterol levels.

Further studies with pork pancreatic cholesterol esterase to determine fatty acid specificity when cholesterol esters were hydrolyzed showed that, of the esters assayed, cholesteryl caproate ($K_m = 3.52 \times 10^{-2}$ M) had the highest affinity for the enzyme. Activity diminished in the order: cholesteryl butyrate ($K_m = 4.91 \times 10^{-2}$ M) and cholesteryl acetate ($K_m = 2.1 \times 10^{-1}$ M). Cholesteryl palmitate, oleate and elaidate demonstrated no hydrolysis after a 24-hour incubation period. Rates of hydrolysis for the cholesterol esters of water-soluble fatty acids were assayed by potentiometric titration. The rates of hydrolysis of the other cholesterol esters were assayed by free and total cholesterol determinations according to the method of Sperry and Schoenheimer.

The fractionation of glycerol-water, bicarbonate pork pancreas homogenates by pH adjustment, protamine sulfate and ammonium sulfate fractionation gave better than a 20-fold purification of cholesterol esterase. A 16-fold purification of cholesterol esterase was achieved when a crude pork pancreas homogenate was eluted from an analytical Amberlite XE-64 column by 0.2 M potassium phosphate buffer, pH 6.0 containing 0.5% sodium cholate.

When a pork pancreatic homogenate was applied to a preparative Amberlite XE-64 column and eluted with 0.2 M potassium phosphate buffer, pH 6.0 containing 0.5% sodium taurocholate, an analysis of the effluents for cholesterol esterase, aliesterase, and lipase demonstrated that these enzymes were found in three distinct but closely associated distributions in the assayed fractions.

Microfilm $2.00; Xerox $4.80. 95 pages.

THE GEOLOGY OF TORBRIT SILVER MINE

(L. C. Card No. Mic 58-7827)

Finley Alexander Campbell, Ph.D.
Princeton University, 1958

Torbrit Mine, which in 1956 was the third largest silver producer in Canada, is located along the upper portion of the Kitsault River, 17 miles north of Alice Arm, in the Portland Canal area of British Columbia. In the Upper Kitsault River area the Hazelton group of rocks of Jurassic (?) age consist of four formations: Lower Sedimentary, Lower Volcanic, Upper Sedimentary and Upper Volcanic. The rocks form a syncline that plunges at 30° in a direction slightly west of north. The Hazelton group was intruded by feldspar porphyry in the late Cretaceous (?) and the entire assemblage was cut by andesite dikes in Tertiary (?) time.

The Torbrit orebody occurs in the Lower Volcanic formation. It is a pod-shaped body plunging 30° NW. and is situated on the northeast end of a vein sheet which strikes N. 50° E. and dips 45° NW. The vein sheet was tensional in origin and the orebody was formed in a horsetail-type shear zone. The orebody is composed of quartz-barite along with jasper, calcite and siderite as the non-metallic minerals, with galena, tetrahedrite, pyrargyrite, argentite and silver as the main economic minerals, and with variable quantities of pyrite, chalcopyrite, sphalerite, magnetite and hematite.

By x-ray fluorescence methods the Sr content of eleven barite samples from crustiform layers was found to vary from 0.52 ± 0.05 percent to 1.05 ± 0.05 percent. The distribution of Sr between solution and barite crystals for 83° C. is such that the Sr/Ba ratio is very much higher in the crystallizing solution than in the resulting crystals. The variation in the Sr content of the barite in this case is thought to be due to variation of the Sr/Ba ratio in the solution, rather than to temperature variations during formation.

Five sphalerite samples were analyzed for FeS, CdS and MnS by x-ray fluorescence methods. The averages in weight percent were 0.72 ± 0.2 CdS, 0.19 ± 0.1 MnS, 2.0 ± 0.2 FeS.

A temperature of 270° C. was determined for the sphalerite by plotting the FeS content of the sphalerite on a portion of the system ZnS-FeS-S, and by employing the argentite-silver assemblage as a sulphur barometer. This is based on the qualified assumption that sphalerite, pyrite, argentite and silver were formed under equilibrium conditions. Even with the above assumption, the uncertainties of the data indicate the temperature of sphalerite formation could range between 230° and 310° C. The deposit formed at about 300 atmospheres hydrostatic pressure and therefore a small additional correction is necessary.

The orebody formed in late Cretaceous to early Tertiary, from solutions genetically related to the last phase of the Coast Range intrusion in the area.

Microfilm $2.55; Xerox $8.80. 194 pages.

BASIN-RANGE STRUCTURE OF SOUTH-CENTRAL OREGON

(L. C. Card No. Mic 59-261)

Fred Arthur Donath, Ph.D.
Stanford University, 1958

The part of the Basin and Range province lying in south-central Oregon has been covered by several thousand feet of late Tertiary basalt flows. The flows have been intricately faulted to form a distinct fracture pattern and conspicuous horsts, graben, and tilted fault blocks. The area selected for study lies in central Lake County, Oregon.

The area is particularly well suited for a descriptive and analytical study of Basin-Range or fault-block structure because the flows were essentially horizontal prior to the faulting, the faulting is recent and remains uncomplicated by later deformation, the fault scarps are little modified by erosion, the rocks are relatively homogeneous and possess favorable mechanical properties, the area appears to have been subjected to reasonably uniform stresses, the fracture pattern is remarkably distinct, and the deformation has been simple enough to lend itself to analytical methods.

For purposes of description the faults of the area have been ranked according to their length and apparent throw as master faults, secondary faults, and subordinate faults. The master faults, which by definition have the greatest length and greatest apparent throw, divide the area into a dozen large sections of nearly equal size; the secondary faults delimit horsts, graben, or tilted fault blocks within these sections; and the subordinate faults modify the individual fault blocks and amplify the structural pattern.

Fault scarps are rather uniformly distributed except in the northeast and southwest corners of the area where there are sediment-covered floors of former lake basins. An 8400-foot seismic refraction profile made across part of one of the former lake basins shows the presence of fault blocks beneath the lake sediments. The reversed profile crosses 4 buried faults whose spacing and throw conform remarkably to observations of exposed faults elsewhere in the area. The dips of the faults are indicated by the seismic interpretation to be very steep or nearly vertical. The throw of the faults ranges from 200 to about 800 feet.

The faults of the area are in two principal sets--one striking approximately N. 35° W. and the other N. 20° E. Evidence indicates that movements occurred concurrently along both sets. The latest and dominant movement on the faults is dip-slip; strike-slip movement had occurred previously. As indicated by the traces of intersecting faults across scarp faces, the presence of pivotal faults, and the results of the seismic investigation, the dips of most of the faults appear to be nearly vertical.

The contemporaneity of the two fault sets, the intersection angle of approximately 55°, and the nearly vertical dips of the faults indicate that the faults originally developed as complementary strike-slip shears in a stress

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

system characterized by a north-south maximum principal stress and an east-west minimum principal stress. This stress orientation did not produce the conspicuous vertical movement that has occurred along the faults. Subsequent block faulting occurred in which the dominant movement was dip-slip. It is not possible to determine how much time elapsed between the development of the fault pattern and the stage of block faulting. The block faulting may not have occurred for some time after the formation of the shears, or it may have followed closely in a nearly continuous sequence of deformation.

It is concluded that the fault displacements which developed the present topography did not result directly from the stress distribution which created the faults; instead, near-vertical movements occurred on the previously formed strike-slip shears.

Microfilm $2.60; Xerox $9.00. 197 pages.

LARGER FORAMINIFERA OF CERTAIN EOCENE AND OLIGOCENE FORMATIONS OF CUBA

(L. C. Card No. Mic 59-447)

Philip Cooper Hewitt, Ph.D.
Cornell University, 1958

Samples were collected at or near the type localities of four Eocene and five Oligocene formations in Cuba in order to determine the faunas of larger Foraminifera. The species obtained as well as faunal lists published by others are the basis for correlating the nine formations. In addition, two Eocene and one Oligocene formations from which no samples were collected are discussed by revaluation of previously published faunal lists. Suggested correlations of these formations with formations in adjacent Caribbean areas are given.

Twenty-two Eocene species were identified of which 3 are from the Cobre formation, 13 are from the Charco Redondo member and 17 are from the Jabaco formation. Samples were obtained at the town of San Luis, the supposed type area of the San Luis formation, but these samples proved to be unfossiliferous. Fifteen Oligocene species were identified of which 3 are from the Jaruco (Tarará) formation, 9 are from the Maquay formation, 6 are from the Nipe Series, 6 are from the Alavar "formation" and 2 are from the Cojímar formation. Critical species are discussed and illustrated. The range of several middle Eocene species is extended into the upper Eocene.

The Cobre formation includes middle and upper Eocene deposits. The middle Eocene part of the Cobre formation is correlated with the Lisbon formation of Florida, the Guayabal formation of Mexico and the "Yellow limestone" of Jamaica. The upper Eocene part of the Cobre, as well as the Jabaco formation and its Charco Redondo member are correlated with the Ocala limestone of Florida, the Tantoyuca formation of Mexico, the Gatuncillo formation of Panama, the Mount Moriah formation of Trinidad, B.W.I. and the Gibraltar member of the "White limestone" in Jamaica. The San Luis formation may be correlated also with these formations. Probable correlations for other Cuban Eocene formations are given.

The Alavar exposures and the Tinguaro formation are assigned to the Oligocene L. (Lepidocyclina) - L. (Eulepidina) zone and correlate with the lower Suwannee limestone of Florida, the Alazan shale of Mexico, the lower part of the middle member of the Caimito formation of Panama, at least part of the Cipero formation of Trinidad and the Brown's Town member of the "White limestone" (= locality J68M, Cole, 1957b) of Jamaica. The Jaruco and Maquay formations and the Nipe Series are placed in the L. (Lepidocyclina) - M. (Miogypsina) zone and correlate with the upper part of the Suwannee limestone of Florida, the Meson formation of Mexico, the Moneague formation (Montpelier member of the "White limestone") of Jamaica, the upper part of the Cipero formation of Trinidad and the upper part of the middle member of the Caimito formation of Panama. The Cojímar formation is assigned to the late Oligocene on the basis of the smaller Foraminifera in agreement with Palmer (1940) and Bermudez (1950). The larger Foraminifera are not useful for correlation as Gypsina vesicularis has a broad stratigraphic range and Operculinoides cojimarensis has not been reported elsewhere.

Microfilm $2.00; Xerox $4.40. 84 pages.

GEOLOGY OF THE NORTHERN GUARICO-LAKE VALENCIA AREA, VENEZUELA

(L. C. Card No. Mic 58-7855)

Theodore Albert Konigsmark, Ph.D.
Princeton University, 1958

The Northern Guarico-Lake Valencia area is in the south central part of the Caribbean Ranges of Northern Venezuela, eighty kilometers southwest of Caracas. Major east-trending faults divide the area into four distinct structural and lithologic units. These are from north to south: the Caracas Group, composed of shelf sedimentary rocks metamorphosed to the greenschist and albite-epidote-amphibolite facies of regional metamorphism; a fault trough containing the Paracotos Formation, which consists of slightly metamorphosed shales, siltstones, and limestones of Maestrichtian age; the Villa de Cura Group, which is made up of a thick sequence of lavas and volcanic sedimentary rocks metamorphosed to the greenschist facies; and younger sedimentary and volcanic rocks which range from Turonian, and possibly Cenomanian, to Paleocene.

Paleontological evidence and comparison of the Caracas Group metasedimentary rocks with metamorphic and sedimentary rocks in nearby areas indicate that the group is late Jurassic to early Cretaceous in age. The stratigraphic position of the Villa de Cura Group is uncertain because it is separated from the Caracas Group by a fault trough of younger metasedimentary rocks. However, no clastic fragments of the Villa de Cura metavolcanic rocks occur in the Caracas Group and beds of metavolcanics similar to the Villa de Cura Group occur in the uppermost formation of the Caracas Group suggesting that the Villa de Cura Group lies conformably over the Caracas Group.

Metamorphism and folding of the Caracas and Villa de Cura Groups occurred in late early Cretaceous (?). This was followed in the Cenomanian (?) by deposition of the Tiara Volcanics, consisting of basalts, diabases, and associated sedimentary rocks.

From Turonian through early Maestrichtian the Tiara

Volcanics and the Villa de Cura Group formed the major source area for sedimentary rocks of the Garrapata and Piedras Azules Formations of the Arrayanes Group. Conglomerates, grits, and lithic arenites of the Garrapata Formation grade laterally and upward into shales and lithic arenites of the Piedras Azules Formation. Sedimentary rocks of the Paracotos Formation occurring in the fault trough between the Caracas and Villa de Cura Groups are similar in age and lithology to the upper part of the Piedras Azules Formation except that they are slightly metamorphosed.

A second period of folding and faulting occurred in the late Maestrichtian or early Paleocene and was accompanied by slight metamorphism of the Paracotos Formation in the north. The Paleocene Guarico Formation, which is divided into a sandstone and shale facies named the San Juan de los Morros Member and a limestone reef facies named the Morro del Faro Member, unconformably overlies the folded and faulted sedimentary rocks of the Arrayanes Group and the metamorphic rocks of the Villa de Cura Group.

Serpentinite bodies, which probably intruded the Caracas Group prior to the late early Cretaceous episode of metamorphism, were reintruded as solid bodies along several faults and may also occur as exotic blocks in the Arrayanes Group. After the late early Cretaceous metamorphism and before deposition of the Arrayanes Group, the Villa de Cura Group was intruded by hornblende diorite and an ultramafic complex composed of olivine pyroxenite and pyroxene hornblendite. Pyroxene diorite and autogenous explosion breccia sills intruded the Garrapata Formation apparently contemporaneous with deposition of the formation.

East-trending folds formed during the late early Cretaceous metamorphism of the Caracas and Villa de Cura Groups were probably the result of a northwest-southeast clockwise shear couple. Right lateral east-trending strike-slip faults which occurred in the late Cretaceous were probably caused by an east-west clockwise couple. If serpentinite bodies along the Santa Rosa-Agua Fria fault zone represent blocks faulted from the Loma de Hierro serpentinite mass then as much as fifty kilometers right lateral movement may have taken place along the fault zone during the late Cretaceous and Tertiary.

Microfilm $2.00; Xerox $7.00. 146 pages.

THEORETICAL AND EXPERIMENTAL STUDY OF SEISMIC SURFACE WAVES

(L. C. Card No. Mic 59-275)

John Tsung Fen Kuo, Ph.D.
Stanford University, 1958

This study consists of two parts. Each part is independent of the other.

Part I deals with the propagation of Rayleigh waves over the surface of a semi-infinite visco-elastic solid. Mathematical expressions of Rayleigh's equation are derived for varying viscous and elastic constants. The ratios of complex Rayleigh wave velocities to complex shear wave velocities are calculated for Poisson's ratio ranging from 0 to 0.5 with internal friction as a parameter. The empirical statement, that rocks having low values of internal friction may be considered as elastic and those having high values of internal friction as visco-elastic, is formally verified.

Lamb's problem on the propagation of seismic waves in a semi-infinite elastic solid is extended to the propagation in a semi-infinite visco-elastic solid. The surface displacements of Rayleigh waves arising from a point source applied normal to the free surface are derived for a two dimensional case.

Part II is concerned with the experimental investigation of M_2 (or Sezawa) and Rayleigh waves near a point source. Field experiments were carried out on a layer of dry clay of uniform thickness, underlain by saturated clay of unknown thickness. This condition corresponds to a high contrast of elastic constants between a solid layer and a solid half space.

A frequency band from 1 to 30 cycles per second was used to cover the essential frequency spectrum of surface waves. This relatively restricted band eliminated body waves from the recordings. Two distinct surface waves, M_2 and Rayleigh waves, immediately followed by Airy phase, were identified and correlated on those seismic records made at distance less than 100 feet from the point source.

The dispersion of both M_2 and Rayleigh waves agrees with the theory of Sezawa and Kanai, and that of Homma. Minor deviations are attributed (1) to differences in Poisson's ratio, which in the present case is approximately 0.45 in both the layer and the half space, and (2) to the velocity increase with depth in the underlying saturated clay.

Observed surface-particle motion of M_2 waves is elliptical progressive, whereas that of Rayleigh waves is elliptical retrograde, in agreement with the theory of Sezawa and Kanai. The major axes of the surface-particle motion trajectory of M_2 and Rayleigh waves tilt away from the source and toward the source, respectively. The tilt of the major axes varies with distance. At greater distances the elliptical progressive particle motion of M_2 waves for the early arrivals shifts to elliptical retrograde. This phenomenon agrees with Nagamune's calculation that surface-particle motion of M_2 waves is elliptical retrograde for short wave lengths and elliptical progressive for long wave lengths for both single and two-layer cases of high contrast of elastic constants.

The analytic result of this study demonstrates the discovery of the simultaneous existence of M_2 and Rayleigh waves at the immediate vicinity of a point source. This work experimentally extends the theory of Sezawa and Kanai to the region near the origin.

The derivation of period equation for a visco-elastic layer overlying a liquid is given in Appendix A. The equation is extended to the symmetric and antisymmetric modes of a visco-elastic plate in a vacuum and in a liquid.

Microfilm $2.60; Xerox $9.00. 199 pages.

GEOLOGY OF THE NORTHWEST FLANK OF THE FLINT CREEK RANGE, WESTERN MONTANA

(L. C. Card No. Mic 58-7864)

George Emmert McGill, Ph.D.
Princeton University, 1958

Most of the Flint Creek Range lies within the Philipsburg quadrangle, about mid-way between Butte and Missoula in western Montana. The northwest flank of the Range includes 100 square miles of mostly mountainous and timber-covered terrane ranging in elevation from 4600 feet to 8400 feet.

The map area is bounded on the south and east sides by the Philipsburg and Royal batholiths respectively; these batholiths form the crest and core of the Range, and most structures in the sedimentary rocks plunge away from them. West of the mapped area lies the Sapphire Range, underlain almost entirely by rocks of Precambrian Beltian age. The northern margin of the map area approximately coincides with the overlap of mid-Tertiary basin sediments that fill the valley of the Clark Fork River north of the Flint Creek Range.

Excluding the discontinuous areas of poorly consolidated Cenozoic sediments, the stratigraphic column of the area totals about 16,000 feet in thickness. About 6000 to 7000 feet of the column is Beltian, mostly argillite and quartzite with carbonate near the base. Rocks of the Cambrian, Devonian and Carboniferous systems total nearly 6000 feet and are almost entirely carbonates. Sandstones and shales dominate the section from the Permian to the Cretaceous.

Gentle folding occurred prior to the Middle Cambrian, and the basal Cambrian rests on the Belt series with slight angular unconformity. Most of the structures, however, were formed between the late Cretaceous and the late Oligocene or early Miocene. The first deformation produced gentle folds, but before these developed to any extent, Beltian and lower Paleozoic rocks were thrust eastward at least five miles over upper Paleozoic and Mesozoic rocks on the Philipsburg overthrust. The thrust truncated pre-existing folds, and the structural complexity was further enhanced during movement by drag folding and splay thrusts. Continuing folding eventually locked the Philipsburg overthrust, and late-stage folds and high-angle reverse faults deformed and broke the Philipsburg thrust plane.

Sometime after the development of the compressional structures, the Royal and Philipsburg granitic batholiths were intruded as liquid magma, in part forcefully. The batholiths deformed the pre-existing structures until the country rock strikes roughly paralleled the batholith margins. No cataclastic structures were found near the margins of the batholiths. Contact metamorphism is well developed.

Coincident with or after batholithic intrusion, the Flint Creek Range was uplifted and structurally differentiated from the valleys around it. These valleys were filled with sediments of Oligocene(?), Miocene and Pliocene ages that have been only mildly deformed. In the late Pliocene or early Pleistocene an erosion surface developed that bevelled Tertiary basin fill and bedrock alike. Dissection of this surface began sometime in the Pleistocene prior to the latest glacial advances and is still going on.

Glaciers occupied many of the higher valleys of the Flint Creek Range during the Pleistocene, leaving many till-choked drainages and cirques.

Microfilm $3.00; Xerox $10.40. 231 pages.

STRUCTURE AND STRATIGRAPHY OF THE FLATHEAD NORTH MAP-AREA (EAST HALF), BRITISH COLUMBIA AND ALBERTA

(L. C. Card No. Mic 58-7882)

Raymond Alex Price, Ph.D.
Princeton University, 1958

This report deals mainly with the stratigraphy and structural geology of 190 square miles of mountainous terrane in the southern Rocky Mountains of British Columbia and Alberta.

Rocks exposed within the area range in age from Precambrian to Cenozoic. The allochthonous Lewis thrust sheet includes 21,000 feet of strata from Precambrian to Late Cretaceous in age. Strata from Late Jurassic to Late Cretaceous in age, 7,500 feet thick, are exposed in the Foothills subdivision below it. The Precambrian rocks are of Purcell age and a regional unconformity occurs between them and the overlying relatively thin Cambrian sequence. Andesitic extrusive rocks are intercalated in the Purcell sequence and diorite sills intrude it. Devonian strata are unconformable on the Cambrian sequence and include carbonate bank and reef complexes. A detailed lithological subdivision of this sequence is presented. The units are utilized in describing the complex stratigraphic relationships, and their correlation is discussed. The Upper Palaeozoic sequence is similar to that known from the region to the north and northeast. A detailed lithological subdivision of the sequence has been found useful in interpreting complex structures. The correlation of these subdivisions is discussed. The Mesozoic sequence is described and evidence indicating the presence of an unconformity within the Lewis thrust sheet, between Blairmore and Kootenay strata, is considered. Lower Cretaceous alkaline intrusive bodies occurring in the Lewis thrust sheet are described and their relationships to the alkaline pyroclastics of the Crowsnest formation, and the feldspathic sediments of the Blairmore group are discussed. Tertiary sediments occurring in the Flathead Valley are described and their genetic relationships to Cenozoic block-faulting are discussed.

Two genetically and temporally distinct groups of structures occur: an older group characterized by thrust faults, sub-parallel to bedding, along which the pre-Cenozoic strata have undergone relative eastward and northeastward displacement; and a younger group consisting of normal faults along which individual blocks have been displaced vertically and tilted.

The Lewis thrust sheet dominates the older group and all elements in the group have been integrated in terms of their relationships to it. It has been displaced a minimum horizontal distance of 25 miles toward the northeast relative to underlying strata. A prominent transverse structure in the thrust sheet is described and its influence on the development of minor structures is considered. Structures indicating a relative eastward thrust displacement are superimposed discordantly on others indicating northeastward displacement. Variations in the stratigraphic position of the Lewis thrust suggest that the thrust sheet moved, in part, in response to gravitational forces acting on it.

The Flathead fault, a west- and south-dipping normal fault, dominates the younger group and other elements in the group can be related directly to it. The stratigraphic throw across the Flathead fault reaches 17,000 feet at the

south end of the area and decreases to less than 1,000 feet in the north. The block lying west and south of it has been tilted toward it and is cut by a complex of minor faults, some of which are antithetic normal faults. An assymetric graben lies adjacent to the Flathead fault on the west and is the site of a prominent physiographic "trench".

Microfilm $5.05; Xerox $16.80. 394 pages.

ORE GENESIS IN THE NAICA DISTRICT, CHIHUAHUA, MEXICO

(L. C. Card No. Mic 59-285)

John Grover Stone, II, Ph.D.
Stanford University, 1958

In the Naica mining district of north-central Mexico, pyrometasomatic and mesothermal replacement bodies of base-metal sulfides with minor amounts of silver and gold occur in a thick sequence of locally marmorized Cretaceous limestone. The only igneous rocks known in the Sierra de Naica, consisting of thin, discontinuous dikes and sills of very fine-grained quartz and adularia(?), have themselves been altered and partly replaced during ore emplacement.

Ore emplacement in the district was controlled by dikes and sills (possibly in conjunction with flat-lying fractures), steeply dipping N 50-60°W fractures, and steeply dipping fractures trending N 25-35°E. Movement took place on faults belonging to both of these fracture sets before, during, and after the period of mineralization. Two structural types of orebody are exposed - gently dipping silicate-sulfide sheets or "mantos", and steeply plunging chimneys of sulfide ore with or without minor amounts of silicates, localized along steep NE or NW faults. The main manto consists of a central zone characterized by the presence of wollastonite, grossularite, and vesuvianite (idocrase), with minor amounts of scheelite. This zone grades laterally into ore containing manganhedenbergite, quartz, and calcite, that was deposited in cooler ground adjacent to the central conduit. The fluids that deposited these marginal zones were depleted in Al, W, and Ag, and relatively enriched in Fe by the deposition of silicates and sulfides in the central zone of the orebody.

The silicates and sulfides were introduced into the manto by a single fluid that did not change in composition during the course of formation of this particular orebody. Silicates were deposited first, followed by sulfides that crystallized from the residual fluid at temperatures on the order of 500-550°C. The mantos were cut by silicate-bearing chimneys of sulfide ore that were in turn succeeded by mesothermal massive sulfide ore during the last stages of mineralization in the district as a whole. Most of the mesothermal ore appears to have been deposited at the same temperature and pressure as the earlier pyrometasomatic ore, suggesting that in this instance, the difference between the two types of ore is due to progressive changes with time in the composition of the ore-forming fluid, rather than to changes in the physical conditions of deposition. The silica, aluminum, magnesium, tungsten, and silver content of the fluid decreased relative to the content of lead, zinc, iron, and sulfur. In addition, the amount of iron carried by the fluid increased markedly with respect to lead and zinc during the course of mineralization in the district as a whole. The chemical potential of sulfur in the mineralizing fluid increased with time, partly due to an over-all increase in the vapor pressure of S_2 in the fluid, and partly due to the drop in temperature during the final stages of any one orebody. While the oxidation state of the fluid as a whole remained nearly constant with time, it did change, due solely to the drop in temperature, during the course of crystallization within each successive orebody. The inferred changes in the mineralizing fluid with time are virtually identical to the changes in the mantos produced by the progressive reaction of the fluid with limestone.

The original sulfide ores have been oxidized down to the water table, with the removal of large quantities of zinc, and the formation of high-grade lead sulfate and carbonate ores. Microfilm $3.50; Xerox $11.80. 269 pages.

HEALTH SCIENCES

HEALTH SCIENCES, PATHOLOGY

MORPHOLOGICAL CHANGES IN THE TRACHEOBRONCHIAL MUCOSA OF RESIDENTS OF CINCINNATI AND ENVIRONS

(L. C. Card No. Mic 58-7633)

Joseph Szolomajer, M.D., Sc.D.
University of Cincinnati, 1958

The purpose of this study was to determine whether or not there is a statistical association between the incidence of squamous metaplasia in the tracheobronchial tree, and the inhalation of environmental pollutants and/or tobacco smoke.

The specific aims:

1. To compare the incidence and severity of squamous metaplasia in urban versus semi-rural dwellers, and in smokers versus non-smokers of both sexes.
2. To see whether or not squamous metaplasia has a predilection for the same areas in the respiratory tract most commonly involved by squamous cell carcinoma.
3. To determine whether or not there is an age-trend in the incidence and severity of squamous metaplasia.
4. To investigate occupations which may show a higher incidence and severity of squamous metaplasia.
5. To define the role of the differences in socio-economic

conditions upon the incidence and severity of squamous metaplasia.

Method of Procedure: The tracheobronchial trees of eighty-one cases (40 plus years old) were serially sectioned and evaluated. Information was available on the following: smoking, diet, occupation, past residences and exposures to general and specific air pollutants, social and economic background, past and recent illnesses, as well as a detailed report on the autopsy findings.

Results and Conclusions: A person's liability to squamous metaplasia is in direct proportion to the degree of air pollution, being several times higher in the strictly urban population of both sexes than in suburban residents ($P<0.05$ for males and $P<0.04$ for females).

There was a significantly greater severity of squamous metaplasia in males who smoked 10 or more cigarettes a day for longer than 10 years ($P<0.01$). All other smokers showed the same extent of metaplasia as the non-smokers. Among the females no correlation whatsoever was found between smoking and metaplasia.

No relationship seems to exist between the number of cigarettes smoked in a lifetime and the amount of anthracotic pigment in the lungs.

Occupations which involve exposures to dusts, fumes, vapors and hot steam, show a high incidence and severity of squamous metaplasia.

Among the poorer classes the males show almost a doubled incidence of metaplasia and the females a threefold incidence over those of the economically better situated groups ($P<0.05$).

There is a marked predominance of squamous metaplasia in males as there is also a relatively high incidence of lung cancer. The male-female ratio is 3:1 as to the severity of squamous metaplasia and also as to the proportion of smokers.

The sites of predilection for squamous metaplasia are identical with those occupied by squamous cell carcinoma, the right lung showing a higher severity than the left.

Morphological and topographical differences exist among persons exposed to air pollutants or to tobacco smoke alone, and to both.

Carcinoma in situ was only twice diagnosed among 81 cases, examining 11,100 sections.

An highly proliferative bronchial epithelium, resembling carcinoma in situ, but lacking certain malignant characteristics has been observed and described. This epithelium has only been present in association with a carcinoma of the lung or of any other epithelial organ, and it is believed to be the result of a "growth" or "proliferation factor" derived directly or indirectly from the primary carcinoma.

Papilla formation occurred only in moderate and heavy cigarette smokers and in persons exposed to considerable quantities of atmospheric pollutants. It is this pathological change that may become the nucleus of a carcinoma in situ.

Sequential sectioning and microscopic examination of the entire tracheobronchial tree revealed a considerably higher incidence of bronchogenic carcinoma than reported by epidemiologists.

Microfilm $2.00; Xerox $5.20. 104 pages.

HEALTH SCIENCES, PHARMACY

HYDROGEN PEROXIDE FORMATION BY ZINC OXIDE IN OINTMENTS

(L. C. Card No. Mic 59-398)

Hector Antonio Lozada, Ph.D.
The Ohio State University, 1958

A study of the production of hydrogen peroxide by ultraviolet irradiation of zinc oxide ointments in the presence of water and oxygen has been made. The formula for Zinc Oxide Ointment, U. S. P., was selected as the basic formula for this series of experiments. The official formula was changed only in respect to the White Ointment. Four other ointment bases were studied to determine the effect of the base on the production of hydrogen peroxide. Aquaphor, Hydrous Wool Fat, U. S. P.; Hydrophilic Ointment, U. S. P.; and Polyethylene Glycol Ointment, U. S. P. along with the official White Ointment base were used in the preparation of samples. The irradiation time in this study was one hour.

A comparison of hydrogen peroxide produced by 2 Gm. of ointment showed that Hydrophilic Ointment produced the greatest amount of peroxide (1,107 micrograms), followed very closely by the water soluble base Polyethylene Glycol Ointment (1,003 micrograms). White Ointment, however, did not show any production of peroxide under these conditions. Aquaphor as well as Hydrous Wool Fat gave no measurable quantities of hydrogen peroxide. It was subsequently shown that oxidation of cholesterol in these bases was affected.

A series of experiments regarding the effect of time of irradiation showed that Zinc Oxide Ointment did not produce hydrogen peroxide after four hours of irradiation. The samples containing zinc oxide with Polyethylene Glycol Ointment gave 841 micrograms of hydrogen peroxide after 30 minutes of irradiation, 1,003 micrograms after 60 minutes, and 1,660 micrograms after 240 minutes.

The effect of temperature was also studied by comparing the fatty bases and Polyethylene Glycol Ointment. The samples containing zinc oxide in White Ointment did not show any production of hydrogen peroxide at room temperature. At 45°C, two grams of the ointment produced 124 micrograms of hydrogen peroxide and at 55°C, produced 2,004 micrograms. Aquaphor and Hydrous Wool Fat gave very low results at 55°C, i.e., 39 and 30 micrograms of hydrogen peroxide respectively. Results obtained with zinc oxide in Polyethylene Glycol Ointment showed that hydrogen peroxide was produced in an appreciable amount (1,752 micrograms) at 0°C. The production of hydrogen peroxide increased with a rise in temperature up to a maximum of 2,575 micrograms per 2 Gm. ointment at 45°C.

Cholesterol alone or as a component of Hydrous Wool Fat was oxidized by the hydrogen peroxide during irradiation when used as a base for zinc oxide. The oxidation of cholesterol produced a mixture of ketones. The infrared spectrographs and chemical tests showed that the cholesterol molecule had undergone oxidation.

Microfilm $2.00; Xerox $5.00. 96 pages.

THE EFFECTS OF USING INVENTORY CONTROL IN THE PRESCRIPTION DEPARTMENT OF THE RETAIL PHARMACY

(L. C. Card No. Mic 59-400)

Arthur Cleveland Lytle, Jr., Ph.D.
The Ohio State University, 1958

Since the late 1930's, advances in medical and pharmaceutical research have produced dramatic new drug discoveries that have changed the course of medical practice. Increasing numbers of trade-marked specialties have been introduced each year, and physicians now prescribe these as a matter of course. As a result, the role of the pharmacist has been changing from that of a craftsman to a professionally trained and licensed dispenser of prefabricated specialties.

At the same time, there has been a major expansion in prescription volume and sales. Much of the sales increase has stemmed from the rapid rate of product introduction during this period. The number of items carried in the pharmacist's prescription department has increased considerably, as has his investment in inventory. Aside from the increase in dollar investment, many drugs have been introduced one year, only to be superseded as the "drug of choice" by a modified or new formula a few months later. Consequently, a large part of the investment is tied up in obsolete or dead stock.

The current pattern of rising investments and lower turnover creates a need for improved control methods, but most pharmacy owners have continued to rely on informal, "buy-as-needed" methods rather than on formal control systems.

In view of the need for developing a workable system of control, an investigation was made into the possibilities of using a periodic inventory system in the prescription department in cooperation with a group of retail pharmacists who were using little or no inventory control. The study group included six retail pharmacies with sales volumes ranging from under $100,000 to $250,000. A control system was installed in five of the stores, but not in the sixth store. The influence of using a control system was observed in these stores over a two-year period of time and evaluated on the basis of changes in investment levels, turnover, buying practices and capital utilization.

Although prescription sales increased at a similar rate in each store, investment levels declined or increased slightly in the stores using inventory control, reversing a trend dating back to 1953. In the sixth store, there was an unfavorable change in inventory status: investment increased at a faster rate than sales. It was also found that the investment in obsolete medicinals was reduced in those stores using the control system.

The study findings demonstrate the value of using a formal inventory system in the prescription department. Such a program can improve inventory balance, increase capital utilization, and simplify the buying task. Satisfactory results can be obtained by placing the control effort on the product lines of the major pharmaceutical companies, whose products constitute the greatest proportion of the total investment. As a result of the improvement in buying efficiency and investment turnover, the expense of operating the system is more than offset by the increase in the profitability of departmental operations.

Microfilm $2.10; Xerox $7.40. 159 pages.

A STUDY OF THE CATION EXCHANGE PROPERTIES OF AMERICAN BENTONITE AND ITALIAN BENTONITE

(L. C. Card No. Mic 59-435)

John Clarence Young, Ph.D.
The Ohio State University, 1958

Volclay bentonite was treated with sulfuric acid, and one acid activated fraction was prepared. This fraction, designated as Bentonite-B, was cation saturated with gentian violet dye to produce Gentian Violet Bentonite-B. Cation exchange reactions of selected alkaloids and drugs were measured by the determination of the dye released from Gentian Violet Bentonite-B after shaking it with various concentrations of the drug solutions. The following alkaloids and drugs were studied: ethyl morphine hydrochloride, morphine hydrochloride, codeine hydrochloride, nalorphine hydrochloride, apomorphine hydrochloride, codeine sulfate, morphine sulfate, meperidine hydrochloride, Nisentil® hydrochloride, methadone hydrochloride, quinine hydrochloride, quinine bisulfate, cinchonine sulfate, cinchonidine sulfate, quinine sulfate, quinidine sulfate, quinine dihydrochloride, 8-hydroxyquinoline sulfate, cocaine hydrochloride, homatropine hydrobromide, hyoscine hydrobromide, atropine sulfate and hyoscyamine sulfate.

It was found that there was no direct correlation between the molecular weights of the large organic cations and the amount of dye released by them from Gentian Violet Bentonite-B. It was shown that steric factors and the degree of ionization had a direct effect on the amount of dye released from Gentian Violet Bentonite-B by the various alkaloidal solutions. The study of several isomer pairs showed that each pair released similar amounts of dye from Gentian Violet Bentonite-B. It was demonstrated that alkaloids in the form of double salts liberated less dye than did the same alkaloids in the form of a single salt, and that in general the hydrochloride salts of the alkaloids released more dye from Gentian Violet Bentonite-B than did the sulfate salts.

In the study of Italian bentonite, it was observed that the physical characteristics of this bentonite were distinctly different from those of Volclay bentonite. An acid activated Italian bentonite was prepared by treating the bentonite with sulfuric acid. This material had a lower ion-exchange capacity than the acid activated Volclay bentonite. The activated Italian bentonite was saturated with gentian violet to produce Gentian Violet Italian Bentonite. In order to use Gentian Violet Italian Bentonite as a dye release reagent, it was necessary to add a small amount of an electrolyte salt to the reaction medium to suppress the desorption of dye from the complex. The amounts of dye released from Gentian Violet Italian Bentonite by quinine hydrochloride and quinine bisulfate were different with each electrolyte salt used in the reaction medium, and these results were different from those obtained when Gentian Violet Bentonite-B was used as the dye release reagent.

Microfilm $2.00; Xerox $4.00. 71 pages.

HEALTH SCIENCES, PUBLIC HEALTH

THE MULTIPLICATION OF ST. LOUIS ENCEPHALITIS VIRUS IN TWO MOSQUITOES, CULEX QUINQUEFASCIATUS SAY AND CULEX PIPIENS LINNAEUS

(L. C. Card No. Mic 59-428)

William Daniel Sudia, Ph.D.
The Ohio State University, 1958

A review of the literature concerning the multiplication of virus within arthropods is presented. Because of the lack of suitable techniques, little has been done to determine the rate of virus multiplication within arthropods. By the alimentary route, high concentrations of virus are usually required to establish infection, and the large amount of residual virus in the gut makes the determination of the early phases of multiplication difficult. The intrathoracic inoculation technique precludes the difficulties inherent with the natural alimentary route of infection and makes possible these determinations.

Groups of Culex quinquefasciatus Say and Culex pipiens Linnaeus were inoculated intrathoracically with varied dosages of St. Louis encephalitis virus by means of a microcapillary pipette. These groups were either frozen immediately or at specific time intervals following inoculation, and then the concentrations of virus in their bodies were determined by the trituration and inoculation of serial dilutions into three-week-old mice. Other groups of these two species of mosquitoes were also inoculated with St. Louis encephalitis virus, and their ability to transmit by bite was tested after varying extrinsic incubation periods.

Following the inoculation of 0.7 LD_{50} of SLE virus, little or no virus was recovered for up to 48 hours in C. pipiens and 60 hours in C. quinquefasciatus. Beyond these time periods, increasing amounts of virus were recovered until a leveling-off, or maintenance level, was attained. In C. pipiens, for example, the virus reached detectable levels (about $10^{1.1}$ LD_{50}) at 48 hours, and then increased in nearly a straight line to a peak at 96 hours of $10^{6.0}$ LD_{50}. Once a detection level had been reached, the rate of increase appeared to be about 10- to 30-fold each 12 hours until the maintenance level was reached. When a higher dose of virus was inoculated, less time was required for the virus to reach peak titers in the mosquitoes. Regardless of the dose given, however, the same high level of virus, or maintenance level, was eventually reached. Also following the inoculation of small doses of SLE virus, the rate of multiplication appears to be equal between the two species of mosquitoes, but the appearance of detectable levels begins about 12 hours earlier in C. pipiens than in C. quinquefasciatus. On the other hand, when larger doses were inoculated, the differences between the two species diminished.

Transmission studies revealed that following intrathoracic inoculation of relatively large amounts of virus, 100 per cent transmission rates were obtained within only four days in both species. Even after inoculation of small doses of virus, a 100 per cent transmitting level was reached in only six days in the C. pipiens and in eight days in the C. quinquefasciatus. In an earlier study, on the other hand, when infection was by ingestion of comparable amounts of virus, a 100 per cent transmission rate was not reached until the twelfth day in C. pipiens and about the twenty-fourth day in C. quinquefasciatus.

The experimental data suggest that the tissues of the digestive tract are responsible for the delay of the movement of the virus to the salivary glands. Such delay would account for the lengthened incubation period required before both species of mosquitoes reach high transmitting efficiency after infection by feeding.

Microfilm $2.00; Xerox $3.00. 58 pages.

HISTORY

HISTORY, ARCHAEOLOGY

SOME DECORATED TOMBS OF THE FIRST INTERMEDIATE PERIOD AT NAGA ED-DÊR

(L. C. Card No. Mic 58-7661)

Caroline Nestmann Peck, Ph.D.
Brown University, 1958

This dissertation describes in detail three large tombs with mural decorations which are located at Naga ed-Dêr, the cemetery for the capital of the eighth nome of Upper Egypt. Each of the three tombs belonged to an important official who lived during some part of the so-called First Intermediate Period. These were Twau, who helped administer royal lands in his district; Tjemerery the Great, who was great overlord of the nome, overseer of prophets in the temple of the city-god, and overseer of royal works in the nome; and Meru, who was overseer of prophets and keeper of the diadem for the city-god.

Each detail of the construction and decoration of these tombs is compared with similar details from tombs elsewhere in Egypt not only to show how fragmentary elements are to be completed but also to help in dating. It is concluded that Twau lived early in Dynasty VIII, Tjemerery late in Dynasty VIII, and Meru in Dynasty IX, not very much before the Theban wars.

The brief inscriptions are translated in full and searched for general information concerning Upper Egypt in the little-known period after Dynasty VI and before Dynasty XI. It has been learned that there were incursions of Nubians, probably in Dynasty VIII, and that the great overlord of the eighth nome helped to repulse them. It has been discovered that a temple of the city-god, Onuris, existed in the nome at this early date, with priests of varying ranks and titles and an elaborate ritual. In the titles of Twau and Tjemerery the Great additional support has been found for the notion that the eighth nome was loyal to the crown in the troubled period after Dynasty VI. However, the complete absence of eighth dynasty royal names in these and all other

inscribed tombs at Naga ed-Dêr is noted as an argument against locating the seat of that dynasty in Abydos, just eight kilometers away.

Microfilm $2.60; Xerox $9.00. 200 pages.

HISTORY, MEDIEVAL

SAINT LOUIS'S ECCLESIASTICAL POLICY IN FRANCE

(L. C. Card No. Mic 58-7828)

Rev. Gerard John Campbell, S.J., Ph.D.
Princeton University, 1957

This study is devoted to the policy followed by Louis IX toward the Church in France. It is limited to the internal affairs of the French Church and deals with the papacy only insofar as such relations affected France internally. At the end of Saint Louis's reign the position of the Church was weaker not because there was an apostasy from the faith or because the prelates were unable to exercise their spiritual functions but because the jurisdiction of ecclesiastical courts was lessened, many churchmen were less independent in exercising their temporal rights and clerics found it harder to enforce the use of censures when temporal matters were involved. Was this movement the result of Saint Louis's policy? If so, to what extent? What measures were used to achieve this end?

The first chapter considers some of the baronial and royal protests to certain conditions which existed within the Church in France. Particular attention is given to the memoir sent to Innocent IV in the name of the king in June 1247. Subsequently, consideration is given to the king's influence on the appointment of candidates to major ecclesiastical offices and to the use of royal rights of patronage. The king's attitude toward pluralities, expectancies, and non-residence is examined briefly. Questions involving the spiritual and temporal regalia are investigated, and the use of clerics in government service is considered. Detailed attention is directed to the royal policy toward the jurisdiction of ecclesiastical courts and to modifications which took place during Saint Louis's reign. The fifth chapter enters into the heart of the relationship between the spiritual and temporal powers by studying the royal policy on the use of ecclesiastical censures. Finally, an examination is made of various temporal rights and possessions which the Church claimed.

A number of factors entered into the diminution of the Church's position in certain aspects of French life. However, it seems certain that the policy followed by Saint Louis was an important force in the development. Saint Louis was a generous benefactor of the Church, and he also tried to correct any injustices which were committed toward ecclesiastics. In his personal dealings with clerics, he tried to be just but he also insisted that his rights should be respected in all things. The temporal possessions and rights of the Church were protected by the king against any attack. At the same time, the king felt that these possessions should help to provide him with aid when he had some extraordinary necessity. It seems, however, that he always obtained authorization for any levies on ecclesiastical property to meet these necessities. The king had some influence on the appointment of men to major ecclesiastical offices, but there is no evidence that he used undue pressure. He was careful to retain his own rights of patronage, and he was able to extend the rights of spiritual regalia. Saint Louis was respectful of the jurisdiction of ecclesiastical courts, but he was able to gain papal approval for modifications which led to some lessening of the extent of this jurisdiction. Similarly, he recognized the right of churchmen to inflict ecclesiastical censures, but when the censure was used to enforce a decision in a temporal matter, he insisted that he be permitted to judge the issue before he would agree to use civil force to enforce the censure. If a cleric used a censure to enforce an unjust decision in a temporal matter, the king used pressure to have the censure removed. In general, the king respected the authority of the Church and churchmen in matters which were spiritual, but he insisted that his proper sphere was the temporal and within it all, clerics included, must respect his rights.

Microfilm $4.10; Xerox $18.60. 317 pages.

HISTORY, MODERN

CANADA AND NATO

(L. C. Card No. Mic 59-259)

Maureen Patricia Cronin, Ph.D.
Stanford University, 1958

This dissertation examines Canada's activity in the formation and development of NATO, the revolutionary defence scheme which provided the free nations of the western world with an adequate measure of security for nearly a decade in the face of Soviet military, political, and economic challenges. Undoubtedly, fear of Russia was the key factor in bringing about its formation, but Canada, a medium-sized power, gave strong and unwavering support for other reasons also. NATO became, in truth, the keystone of Canada's external policy because it regarded the pact as an admirable instrument to maintain harmonious relations among the United States, Great Britain, and France, as a medium for increasing international economic collaboration, as a forum for the discussion of thorny political problems, and, finally, as an organ for social and cultural co-operation.

This study, which covers the period from the beginnings of NATO in 1948 through the important "summit" meeting of heads of member governments in December, 1957, is based principally upon the parliamentary debates of Canada and the documents and publications of the Departments of External Affairs and National Defence. The voluminous periodical literature on the subject has also proved a fruitful source of information, while newspapers such as the Toronto Globe and Mail, the Montreal Gazette, the Toronto Financial Post, the Montreal La Presse, and the New York Times have provided valuable estimates of the Canadian position.

Canada, through its able statesmen, Prime Minister

Louis St. Laurent and Minister of External Affairs Lester B. Pearson, campaigned zealously for the formation of NATO and warmly welcomed the establishment of the alliance on April 4, 1949. From the military viewpoint, Canada made substantial contributions to the North Atlantic Treaty Organization through its Mutual Aid Program and its NATO Aircrew Training Program. Yet, the Canadian contribution was on a strictly limited basis and it refused to comply with the demands of its partners to initiate conscription and to send material resources--other than military supplies--and money to the nations of Western Europe in order to improve the living standards of nations in this area. From a non-military viewpoint, Canada's contribution was more significant. It was chiefly through Canadian instrumentality that Article II, the provision for the promotion of international economic collaboration and the development of conditions of stability and well-being, was incorporated in the treaty. Likewise, it was Canadian initiative which resulted in the implementation of this article and the development of closer social and cultural ties among the nations of the North Atlantic community. Although Canada was not able to bring about any large-scale development of non-military co-operation, it succeeded in shaping the thinking of NATO planners so that, by the end of 1957, the principal civilian and military representatives of member nations realized that peace and security could not be assured on a military basis alone.

From an analysis of the Canadian activity in NATO, it is clear that Canada successfully undertook the role of mediator in instances of clashing national interests, exercised influence novel in its diplomatic history, and demonstrated a remarkable consistency in its pursuit of non-military objectives for NATO. Canada's role in NATO was definitely an important one in the period under study, and it showed its ability in promoting democratic ideals for the preservation of peace. Microfilm $4.65; Xerox $15.60. 364 pages.

R. D. HUME: ROGUE RIVER MONOPOLIST

(L. C. Card No. Mic 58-7475)

Gordon Barlow Dodds, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor Vernon Carstensen

This study is the biography of a nineteenth century capitalist in an underdeveloped economic area. R. D. Hume (1845-1908) was a pioneer in the salmon canning industry in the United States and his adult life spanned the years from its foundation until its development into a solid economic institution. To trace the life of Hume as capitalist, hatcheryman, salmon canner, and creator and defender of his "ownership" of the Rogue River in southwestern Oregon is the purpose of this thesis.

There are many sources for Hume's life. They include his personal and business papers, his own writings, newspapers of Oregon, records of the federal and state fish commissions, county records in Oregon and California, and collections of papers bearing on the fishing industry of the Pacific Coast. Interviews and correspondence have been conducted with those who knew Hume or knew of him. Pertinent secondary works have been consulted on the salmon canning industry and on other aspects of Hume's career.

Hume's life followed largely in the pattern of the nineteenth century capitalist. He was acquisitive and ruthless in the pursuit of material wealth. He used the power of government, national, state, and local, to further his career at the same time that he was inveighing against government paternalism. He believed in hard work and the righteousness of those who had made substantial material fortunes. Yet in one important respect he was not typical of the businessman of his time.

Hume's major contribution was in the field of artificial propagation of salmon. At a time when conservation was generally sneered at, Hume saw its value and began conducting hatchery experiments on Rogue River. In so doing he was able to maintain a steady supply of salmon throughout his career when the packs on other rivers were declining. Hume was also diligent and persistent in advocating his theories of artificial propagation in the face of indifference or ignorance on the part of the Oregon Fish Commission. Many of his theories are practised today.

Hume was also successful as a member of the salmon canning industry. His business was based on a staunch belief in the value of monopoly. He would stop at nothing to defend his monopoly: as lobbyist, legislator, litigant, hatcheryman, propagandist, and employer of brute force, Hume fought for his fishery. He was always able to maintain it in the face of intermittent attacks throughout his business career.

Hume made a substantial contribution to the history of the salmon industry by his many writings on the subject. In the pages of his newspapers, his autobiography, and his book, Salmon of the Pacific Coast, Hume recorded the problems and successes of the salmon canners from the inception of the industry in 1864 on the Sacramento River through its move to the Columbia River in 1866 down to the year of his death in his own town of Wedderburn on the Rogue River in 1908.

This biography attempts to portray a man who was interesting in himself; Hume was colorful, contentious, litigious, ruthless, and self-righteous. More important, this essay is a case study of a nineteenth century frontier entrepreneur whose deeds and writings made a substantial contribution to an important segment of the economy of the Pacific Northwest.

Microfilm $4.85; Xerox $16.20. 379 pages.

A PHILOSOPHE VIEWS THE FRENCH REVOLUTION: THE ABBÉ MORELLET (1727-1819)

(L. C. Card No. Mic 58-7844)

David Crockett Gordon, Ph.D.
Princeton University, 1957

Adviser: Professor R. R. Palmer

While not an original mind, Morellet deserves study both because he was a representative philosophe who has been neglected, and because he survived the Revolution to be the last early Encyclopedist to defend the philosophic tradition against its neo-Christian and early Romantic critics in the first part of the nineteenth century. Morrellet repudiated the Revolution after contributing to its early stages; he defended Philosophy to his last days, refusing to admit any relationship between the Enlightenment and the Revolution.

As a philosophe in the eighteenth century, Morellet wrote articles on theology for the Encyclopedia (he was educated at the Sorbonne), and played a leading role in the defense of Philosophy against enemies like Palissot. Morellet was also an économiste, in the tradition of Vincent de Gournay and Turgot, and as such, he served the government as propagandist on several occasions when it sought to effect reforms in the mercantilistic structure of the ancien régime. In 1769 he made his most significant contribution when he wrote the most important mémoire against the East India Company which was shortly afterwards suspended. In 1774-76 he served unofficially, the Turgot ministry. Later, as an "Americanist" he befriended and helped Franklin in his efforts to publicize the American cause, and he translated Jefferson's Notes on Virginia into French. In 1788-89, Morellet looked forward optimistically to important reforms in the French government and wrote pamphlets in defense of the Third Estate.

However, he soon became disillusioned with the Revolution. Among the reasons for his disillusionment were his loss of a sizable personal income, the participation in politics of the masses, the execution of intimate friends, and, on an ideological level, the transgression by the Revolutionaries of what he held to be the sacred principle of private property, particularly when the property of the Church was sequestered. Morellet wrote pamphlets against the governments of the Revolution when he could, and he was delighted when Bonaparte overthrew the Directory. But while an enemy of the Revolution, Morellet continued to defend the principles of Philosophy, and he repudiated the notion advanced by the enemies of the eighteenth century that the Revolution had been the result of avoidable mistakes, not of ideas. One conclusion of this thesis is that Morellet was sophistic in his exoneration of Philosophy and that he, himself, had helped to prepare the way for the Revolution.

In his last years, Morellet's main contribution to the defense of his tradition, was to oppose the philosophical and aesthetic principles of the neo-Christians and the early Romantics, Chateaubriand in particular. To his last days, Morellet, as one of the Ideologues, remained true to his economic principles and to the philosophical values of the Encyclopedists; he was never able to accept the Emperor, mainly because Napoleon was a mercantilist and because he tried to suppress the Ideologues. Morellet as a very old man welcomed the Restoration; had he lived longer he would probably have become disillusioned with its illiberalism. Microfiln $5.30; Xerox $18.80. 413 pages.

THE EGYPTIAN QUESTION IN FRENCH FOREIGN POLICY, 1881-1904

(L. C. Card No. Mic 59-271)

Nancy Ann Kane, Ph.D.
Stanford University, 1958

The Egyptian question assumed the proportions of a problem second in importance only to the "lost provinces" in French foreign policy during the last two decades of the nineteenth century.

Since 1876 France and Great Britain had shared a position of predominance through their financial, quasi-political dual control of Egypt. When an Egyptian nationalist revolt exploded in 1882, the French foreign minister--caught in a dilemma of uncertain parliamentary support and a general public wariness towards overseas ventures--dared not sanction participation alongside the British to suppress it. Very shortly afterwards, the French found themselves excluded from their previous position of preponderance in Egypt. Had they been able to muster any foreign support in opposition to Britain's veritable prise de possession, the French could have successfully challenged the British action. Unfortunately for the French, however, the great powers remained benevolently neutral towards Great Britain.

In 1884-1885, through a temporary rapprochement with Germany, the French government did succeed in blocking British attempts to free Egypt from its international financial fetters. For the most part, however, France labored alone to solve its grievance. Viewing Egypt as vital to the government of the republic for reasons of tradition and prestige, Quai d'Orsay officials labored more or less energetically either to force the British evacuation of the khedivial country or to acquire some suitable compensation. To achieve their objective during the years 1882-1890, the French government pursued a rather negative policy of pinpricks and petty obstruction vis-à-vis British action in Egypt. By 1890, the French were conscious of the futility of their policy and realized that the British government was consolidating its position in Egypt. They therefore resolved to inaugurate a more positive policy themselves.

According to plan, the French government intended to send a mission to occupy a point--Fashoda--in the Mahdist-dominated Egyptian Sudan in order to force on Great Britain pourparlers which, theoretically, would lead to the British evacuation of Egypt. As a support to this first group, a second, larger mission approaching from the east and in conjunction with Abyssinian armies, would converge on Fashoda. Three years elapsed, however, before the first mission--Marchand's--strated for the Nile. After a two-year-long journey, Marchand arrived at Fashoda only to learn that he was unsupported from the Abyssinian side. He soon learned that neither would the Quai d'Orsay sustain him. Within a matter of weeks Marchand stood face to face at Fashoda with Kitchener, the sirdar of the Anglo-Egyptian army and the victorious conqueror of the Sudan.

Torn by domestic scandals, challenged by superior British forces, and lacking any international support, France was hopelessly unprepared for the logical outcome of its Egyptian policy. Consequently, the French foreign minister could only give orders for the unconditional evacuation of Fashoda.

In the following year, 1899, Delcassé succeeded in salvaging a favorable territorial delimitation in central Africa by abandoning all claim to the upper Nile region. France had given up its most useful weapon, but the Egyptian question still remained to be solved. The final settlement occurred in 1904 when Great Britain realized that a changed international situation bespoke the necessity of an end to Anglo-French hostility. Britain offered France a free hand in Morocco in return for the same privilege in Egypt. France acquiesced and a diplomatic conflict of twenty-two years duration, kept alive by wounded national pride seeking compensation, drew to a close.

Microfilm $3.55; Xerox $12.00. 274 pages.

CHARLES BRANTLEY AYCOCK: A BIOGRAPHY

(L. C. Card No. Mic 59-55)

Oliver Hamilton Orr, Jr., Ph.D.
The University of North Carolina, 1958

Supervisor: Fletcher M. Green

Charles Brantley Aycock was born near Fremont, North Carolina, in 1859. He graduated from the University of North Carolina in 1881. He practiced law in Goldsboro, 1881-1901 and 1905-1909, and in Raleigh, 1909-1912. He served as city attorney, county attorney, and United States district attorney. Education and politics were strong non-professional interests. He taught school; campaigned for school taxes; and served as Wayne County superintendent of public instruction, board chairman of the Goldsboro city schools, and director of a state normal school for Negroes. He made numerous speeches for the Democratic Party in every important election campaign; twice he was chosen presidential elector. He served as governor of North Carolina, 1901-1905. At the time of his death in 1912, he had begun a campaign for the Democratic nomination to the United States Senate.

Aycock was elected governor on a platform of education and white supremacy. At the same election, a constitutional amendment containing a literacy test for suffrage and a grandfather clause was adopted. Governor Aycock sponsored a program for "universal education." He favored racial segregation but defended the Negroes' right to an adequate public school system. Under his leadership, the legislature increased appropriations for the public schools and the higher educational institutions, established a rural school library fund and a loan fund for schoolhouse construction, set standards for schoolhouses, and founded a teacher's college for the isolated mountain communities. Aycock organized a state-wide campaign resulting in adoption of local school taxes, consolidation of small districts, and construction of schoolhouses. Aycock also assisted in writing a temperance law; instigated increased appropriations for pensions, charities, and hospitals; advocated a fair election law; recommended safety regulations for railroad operation, increased tax assessments on railroad property, and added powers for the Corporation Commission; encouraged the work of the state geologist; strengthened the department of agriculture; and promoted the good roads movement. He tried to prevent lynchings and proposed an anti-lynch law. He utilized the convict lease system, but at the same time he reformed clemency procedures, followed a generous clemency policy, and advocated a reformatory for young criminals and improved facilities for the criminally insane. He sponsored a child labor law and declined to interfere in a railroad laborers' strike. In the South Dakota bond suit, he successfully opposed full payment on all but ten outstanding bonds issued by North Carolina during Reconstruction. In the Atlantic and North Carolina Railroad receivership case, he defeated an effort to compel the lease of a state-owned railroad; later he leased the road to a company of his own choice.

Aycock was a persuasive orator, a skillful courtroom attorney, and a magnetic personality. His major contribution to North Carolina was three-fold: (1) he strengthened the role of the state government as an agency to serve the people, (2) he led in the creation of a durable party structure which facilitated continuous growth of governmental services, and (3) he espoused high ideals and objectives for the attainment of which he inspired people to strive.

The source material on Aycock includes abundant newspaper files, state documents, memorial writings in his honor, and memoirs of his friends. His own writings are limited. A few complete addresses have survived, along with many fragments. A file of a newspaper which he edited for three months contains editorials. Official letters occur in the North Carolina Superintendent of Public Instruction Papers, the District Attorney Letter-Books, and the Governor's Office Papers. Collections of private manuscripts of his contemporaries contain occasional Aycock letters. A rich collection of Aycock letters exists for the period, 1909-1912.

Microfilm $6.90; Xerox $24.00. 543 pages.

NATIONAL UNIVERSITY OF MEXICO: REBIRTH AND ROLE OF THE UNIVERSITARIOS (1910 - 1957)

(L. C. Card No. Mic 59-178)

Valdemar Rodríguez, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Carlos E. Castañeda

The purpose of this study is to show the part played by the universitarios - those associated with the University as students, ex-students, professors or administrators - in obtaining autonomy for the National University and their constant struggle to bring about the social, economic, and political justice promised by the Revolution to their country. Three incidents - the presidential election of 1929, the general student strike of the same year and the Tabasco massacre are narrated quite at length because they are vivid illustrations of how the universitarios joined hands as they worked for a better university and a better Mexico.

This study falls into four well defined periods - the re-establishment in 1910 and its early development to 1929, the circumstances attendant upon the promulgation of the first Organic Law in that year, the second Organic Law of 1933 and its effect and the third Organic Law of 1944 under which the University still operates. Despite the Revolution, the first period (1910-1929) was one of relative academic tranquility until interest in the continent-wide university reform movement agitated the student ranks and aroused consciousness of the need for changes in the internal administration of the institution and its curriculum, all of which resulted in the best staged of all student strikes. This brought about partial autonomy for the University, the Government retaining a large measure of control through the economic subsidy required for the operation of the institution. The chief executive retained the right to appoint the rector of the National University, but the school executives and the administrative staff won a free hand in the conduct of the institution.

By 1933 Communism had undeniably infiltrated all University ranks and a general strike by students and faculty was the reply to the demand by radical leaders that Marxism be taught in the classrooms. Once again the Government was forced to intervene, and as a result the Organic Law of 1933 was passed and almost put an end to the

re-established University. When towards the close of 1944, the situation became unbearable and public opinion had been aroused to the urgent need for modification of the basic regulations, the National Government issued the third Organic Law of 1944 which made significant changes in the administration, limiting the excesses resulting from the professors' and students' unscrupulous participation in the selection of the rectors and the directors of the various schools and colleges. It marked a new era that brought the institution to a more reasonable and practical level in which autonomy could be exercised more sensibly by both the staff and the students.

Ever since its re-establishment in 1910, through the unselfish and tireless efforts of the great Mexican educator and philosopher, Justo Sierra, its institutional life, as well as that of its administrators, professors and students, has been deeply affected by the stormy political life of the country in its struggle for a better day. Two major factions, the liberals and the conservatives, have matched wits and fought a constant battle for control of the institution. The struggle has often degenerated into personal feuds made worse by the conflict between administrators and professors themselves, all of which has produced at times a situation as confusing as it was chaotic. The politicians took an active part during the stirring days of the active Revolution that further confused the situation by siding with the contesting factions within the University. Students added fuel to the fire by constantly striking against administrative and academic reforms and at times wrought inevitable physical destruction to the University plant, the result of strikes that inevitably aroused the hostility of the Government, the administrators, the teaching staff and the public against the students.

Microfilm $4.60; Xerox $15.40. 357 pages.

RUSSIAN CENTRAL GOVERNMENTAL INSTITUTIONS, 1725-1741

(L. C. Card No. Mic 59-140)

William Slany, Ph.D.
Cornell University, 1958

This is a study of the evolution of Russian central governmental institutions in the generation following the death of Peter the Great. Peter's brilliant and tumultous reign marked the foundation of the modern Russian imperial state, but his administrative reforms were incomplete, the new institutions imperfect and immature, and the whole state structure heavily dependent upon the Emperor-reformer for initiative and guidance. After 1725, sovereign power fell victim to instability and confusion as an unfortunate series of unqualified women and hapless children ascended the throne and precipitated a long, painful, and confused period of government by favorite. While political leaders waged incessant internecine struggles among one another, and the gentry sought to entrench their privileged position, the new state system underwent a severe trial as it pursued an uncertain course through wars, economic difficulties, financial crises, and administrative confusion and misconduct.

Making use of published laws and orders, the journals, reports, and other communications of state institutions, the letters, memoirs, and memoranda of court and state officials, and the reports of contemporary observers, especially the foreign envoys at the Russian court, this study examines the fate of the new state organization from 1725 to 1741. Great attention is devoted to the origin, development, activities, and fate of the supreme governmental institutions of the period -- the Supreme Privy Council, the Cabinet, and the Senate. The conduct of the central government in foreign relations, military, naval, economic, financial, commercial, judicial, police, religious, control, and general service matters as well as the agencies and officials with responsibility or authority in these areas are examined in detail. Description and analysis are directed towards determining the efficacy and durability of Petrine organizations and practices, the nature and significance of governmental changes introduced by Peter's successors, the role of individual officials, and the general character of central governmental operations.

The study concludes that the rivalry among powerful favorites, the failure to attain stability in the exercise of sovereign authority, and a crisis in leadership contributed to a serious disorganization of the state structure and a deterioration of the Petrine system. However, there was no widespread or purposeful reorganization of the state or reaction against Peter's reforms. Petrine institutions and practices provided a stable framework which allowed the business of government to be carried on and the consolidation of the state to go forward no matter how desperately the struggle for power was pursued.

Microfilm $7.65; Xerox $26.40. 602 pages.

PHILIPPINE SOCIAL STRUCTURE AND ITS RELATION TO AGRARIAN UNREST

(L. C. Card No. Mic 59-286)

David Reeves Sturtevant, Ph.D.
Stanford University, 1958

It is a paradox that agrarian unrest should exist in the Philippines. Blessed with fertile soils and adequate rainfall, rich in resources of the land and sea, capable of supporting a much larger population than that now residing within its boundaries, the Philippines should be an area of abundance and peace on the periphery of poverty-stricken, strife-torn Asia. Unfortunately this has not been the case. Rural discord has been a chronic problem in the Islands for more than a generation. Central Luzon in particular has witnessed repeated uprisings against the prevailing socio-economic order. The Hukbalahap was but the latest manifestation of deep-seated peasant discontent. Although in recent years the Communist movement has withered to the point of death, the conditions which led to its germination and flourishing growth continue to exist. Until they are eliminated the future of the Philippine Republic will be threatened.

The basic conclusion derived from this study is that the forms of rural social organization are the key factors in agrarian unrest. For the sake of convenient analysis the dissertation is divided into two parts. Part I deals with the evolution of Philippine social structure. Emphasis is placed upon the class system, but economic organization, religion, and political life are considered in relation

to the divisions of society. This section surveys the intermingling of indigenous social patterns with Spanish and American institutions, and demonstrates how the acculturation process first brought into being acceptable configurations of rural relationships and then introduced elements of change which led to the breakdown of those patterns. A result of this breakdown was peasant discontent.

Part II deals with agrarian unrest. This section surveys the development of traditional protest patterns, and concludes with a detailed analysis of the Sakdalista uprising of 1935. The movements considered constitute the heritage of the Hukbalahap. Throughout history the Filipino tao has rebelled periodically against the conditions of his existence. Bandit chieftains, malcontents, nativistic prophets of doom, psychotics, and charlatans have all at one time or another attracted the peasant's loyalty. An appraisal of the origins of Colorumism, the Bucas Grande uprising of 1924, the abortive Kapisanan insurrection of 1924, the Intrencheradista rebellion of 1927, the Moncadista movement, and the Tayug outbreak of 1931, reveals the unsophisticated character of traditional protest patterns. A semblance of competent leadership for the peasantry did not appear until the emergence of Sakdalism in 1934. Led by Benigno Ramos, a disgruntled civil servant, together with a handful of disenchanted intellectuals, conscience-stricken landlords, and alienated members of the middle class, the Sakdalista movement marked the transition from blind response to frustration on the one hand to the recent well-organized and near-successful rebellion on the other.

Research for the dissertation was conducted in the papers of Joseph R. Hayden at the University of Michigan. Reports and official correspondence collected by Professor Hayden during his sojourn as Acting Governor-General of the Philippines proved to be particularly revealing. The Hayden Collection contains more than thirty typescript reports, letters, radiograms, and intelligence memoranda, concerning Sakdalism and the uprising of 1935. Many of the items have no duplicates in the National Archives. The Collection also contains numerous manuscripts, several significant unpublished papers, research files, rare periodicals, and extensive newspaper clipping files covering Philippine affairs from 1934 through 1941. It is hoped that a study based upon these materials will help dispel some of the confusion surrounding the Sakdalista movement, and at the same time contribute to available knowledge of other obscure but important precursors of the Hukbalahap.

Microfilm $3.35; Xerox $11.40. 259 pages.

JAMES HENRY HAMMOND, SOUTH CAROLINIAN

(L. C. Card No. Mic 59-59)

Robert Cinnamond Tucker, Ph.D.
The University of North Carolina, 1958

Supervisor: Fletcher M. Green

James Henry Hammond was born in Newberry District, South Carolina, November 15, 1807, the eldest child of Elisha and Catharine Fox (Spann) Hammond. He was graduated from South Carolina College in 1825 and taught school until, after reading law, he was admitted to the bar in 1828. As editor of the Columbia Southern Times during the nullification controversy, he attracted the attention of the political leaders of the state. After his marriage to Catharine Elizabeth Fitzsimons in June, 1831, he became a planter, leaving Columbia to manage his wife's plantation, Silver Bluff, in Barnwell District on the Savannah River.

Elected to the United States House of Representatives in 1834, Hammond served from December, 1835, until February, 1836, when ill health forced his retirement from Congress. After eighteen months travel in Europe, he returned to Silver Bluff and soon became a candidate for governor of South Carolina. Defeated in 1840, Hammond was elected in 1842 and served a two-year term with distinction. It was during and immediately after his term as governor that Hammond wrote his best-known defenses of Southern slavery.

Defeated in the senatorial election of 1846, Hammond was elected a delegate to the Southern Convention of 1850. However, he would not attend the second session of the Convention. This refusal was instrumental in his failure to be elected to the Senate in 1850. During the years of retirement, Hammond devoted himself to the improvement of his property. He operated his plantation efficiently, marled his cultivated land, drained swamps, and conducted scientific experiments in agriculture. In 1856 he moved to the Redcliffe estate in adjoining Edgefield District but continued to supervise the operation of Silver Bluff plantation.

In 1857, against his expressed wish, Hammond was elected to the United States Senate, where he served until his resignation following the election of Abraham Lincoln in 1860. His health too poor to seek political office in the Confederacy, Hammond made his contribution to the war effort as a planter and buyer of government bonds. He died on November 13, 1864, and was buried on the Redcliffe estate. Ambitious, egotistical, and supremely loyal to his native state, Hammond is best known for his writings in defense of slavery and as a propagandist for and practitioner of scientific agriculture.

Microfilm $6.35; Xerox $22.20. 497 pages.

IMAGES OF THE AMERICAN CHILD IN THE NINETEENTH CENTURY

(L. C. Card No. Mic 59-745)

Bernard W. Wishy, Ph.D.
Columbia University, 1958

Although children's literature and nurture books have existed in America since the time of the Puritans, popular enthusiasm for advice on nurture became established only a century ago.

The first significant popularized views on raising the child appeared in the generation before the Civil War. Within the context of an evangelical tradition that was doctrinally increasingly vague but still intensely moralistic, ideas of the child's capacities for moral growth or regeneration attracted many writers. Despite their differences over the extent of the child's abilities, they were all concerned with safeguards for an absolutist conception of character against the temptations of worldliness, vice, and impiety. The more orthodox writers believed that the potentially wicked child could be saved from sin and their advice stressed the means by which this might be done. While

other writers acknowledged the supremacy of religion they concentrated their attention on inculcating moral and social responsibilities. Both groups, convinced that the child was pliable, were fervent about training him to accept identification with fixed principles of morality, religion, and patriotism. More astute treatment of the child and the securing of his happiness were seen as means to enlist him in the service of truth.

This increasing use of benign naturalistic insights about the child as a basis for achieving universally esteemed spiritual goals can be demonstrated as the predominant trend in nurture literature throughout the nineteenth century.

From 1830 - 1860 the consequences implicit in the idea of the child as a redeemable creature can be examined in the advice given on moral and religious training, education, daily care, and in children's books. Such ideal images as Rollo, the hero of a popular series of boys books by Jacob Abbott, one of the leading nurture reformers, were used to strengthen the child's resolve to serve unquestioned truths of life. Like his parents, the child was given assurance that his loyalty to an inflexible moral law would bring him success and salvation.

After the Civil War this picture darkens. In children's books the child's nature is fully redeemed but the world no longer easily rewards the pious, dedicated and virtuous children like Elsie Dinsmore or the Alger heroes. The child may be an angel but the world is turning into a hell in which the old ideals no longer seem to work with ease.

Nurture writers and the early progressive teachers, however were more confident than the story writers. As the idea of infant depravity disappeared, the information about the child made available by new scientific and evolutionary studies increased the zeal for a training adjusted to the child's capacities but clearly pointed towards benign but still absolute moral goals.

The child was not only redeemable but, properly trained, was envisioned as the future redeemer of the republic. His loyalty to principle was to stem or reverse the tide away from the world of the old American character. The ideals of 1830 - 1860 had to be made to work against such threats as the ignorance of immigrants and vice of the slums, the "commercial spirit" and a pluralistic society without a strict uniform moral code.

While the exceptional literary hero in this setting is capable of dealing successfully with a corrupted world, most of the ideal children in books reject the world when its demands or its price for success are too onerous. In adventure stories, often they retreat from the threatening world to what is depicted as an idyllic home or village life in which purity, character, and faith still work.

Microfilm $5.05; Xerox $16.80. 394 pages.

AGRIPPA D'AUBIGNE: HUGUENOT HISTORIAN

(L. C. Card No. Mic 59-434)

Malcolm Morgan Wynn, Ph.D.
The Ohio State University, 1958

The illustrious Huguenot poet, Agrippa d'Aubigné (1552-1630), was also a consecrated historian of the fortunes of contemporary French Protestantism. Despite the numerous excellent works concerned with d'Aubigné's poetry and the publication of Armand Garnier's definitive biography, no historiographical studies have been devoted to him. D'Aubigné's lengthy Histoire universelle merits its pretentious title neither chronologically nor geographically, for it is primarily a history of France from 1553 to 1602. Nevertheless, it is one of the most significant historical works published in France about 1600.

D'Aubigné was well equipped to narrate the atrocities and tragedies of these strife-torn years. From birth he was intimately associated with the Huguenot cause. In 1573 he became the squire of Henry of Navarre (later Henry IV) and was Navarre's loyal supporter until his abjuration of Protestantism in 1593. D'Aubigné came to occupy an important role in the counsels of the Huguenot party until he was forced to flee France in 1620 and retire to Geneva.

This impassioned Huguenot, who fought with pen and sword for Protestantism, proved to be a remarkably impartial historian. He conscientiously sought truth and accuracy in his Histoire. Unfortunately, his accuracy was much inferior to his objectivity. Certain mistakes can be attributed to his sources, which he followed too slavishly and often uncritically in the first two tomes of his history. Only in the third and last tome of the Histoire universelle did d'Aubigné exhibit much originality. This is indicated by a detailed study of the sources for his accounts of the reign of Francis II, the St. Bartholomew massacre, the years 1576 and 1577, and the assassinations of the Guises and Henry III in 1588 and 1589. For the reign of Francis II he merely summarized the magisterial history of Jacques Auguste de Thou. The latter's work was his chief source for the period of the St. Bartholomew tragedy, but he also borrowed extensively from the Mémoires de l'estat de France sous Charles neufiesme . . . . Most of his narrative concerning the years 1576 and 1577 was copied or summarized from La Popelinière's Histoire de France. . . . On the other hand, his account of the dramatic occurrences of 1588 and 1589 is highly original. For this period d'Aubigné was much less indebted to printed sources than previously.

D'Aubigné's historical characterizations possess more validity and insight than his accounts of specific events or his analyses of developments. He interpreted accurately and objectively such diverse personalities as Admiral Coligny, Catherine de Medici, Henry III, and Henry IV. However, descriptions of occurrences like the origin and growth of the Catholic League, the abjuration of Henry IV, the issuance of the Edict of Nantes are often jejeune and superficial. Furthermore, he was often inaccurate when handling dates, names, and other details.

D'Aubigné's hasty methods of historical composition were responsible for many errors. His religious fervor and lack of historical discernment resulted in much superficiality. His primary interest in military history partially explains his shallow political interpretations. His military descriptions, which comprise the major portion of the Histoire, are frequently boresome and confused.

To the science of historiography d'Aubigné made little contribution, yet he probably ranks second to de Thou among French historians of the era. Today the Histoire universelle has slight appeal to intelligent readers for other than its stylistic brilliance and certain evocative characterizations. To the professional historian Tome I and much of Tome II are virtually valueless, but portions of Tome II and most of Tome III are invaluable contemporary sources. Microfilm $4.65; Xerox $15.60. 364 pages.

SCALES FOR MEASURING ATTITUDES TOWARD PARTICIPATION IN DECISIONS ABOUT USES OF FAMILY INCOME

(L. C. Card No. Mic 59-1126)

Gladys Winifred Babcock, Ph.D.
Iowa State College, 1958

Supervisor: Hester Chadderdon

This research involved constructing instruments for measuring attitudes toward participation of family members in making decisions concerning uses of income. The instruments were planned for use with high school, college and adult groups before instruction to determine curricula needs and following instruction to determine effectiveness of teaching.

Tentative forms of the scales were developed from a pool of suggestions obtained from literature, specialists, high school and college students and adults and consisted of questions concerning uses of income, the family members who might make these decisions and, in a few instances, the method used in making decisions. A preliminary evaluation of these forms was made by graduate students and specialists in home management, child development, family relations and sociology.

The experimental scales were submitted to more than 100 high school pupils, college students and adults, those for the former being administered in four schools attended by white and Negro pupils and representing various socio-economic levels in one city. Those for college students were administered in one university. The adults were from such groups as Parent-teachers, home demonstration clubs, sorority alumnae, classes of graduate students and several individuals.

A key was determined by 10 judges who were specialists in home management, child development, family relationships and sociology who used a definition of autocratic behavior in determining the extent of this behavior implied in each item. When judgments were evenly divided, the investigator acted as a judge. For those items considered less autocratic the values of 5, 4, 3, 2 and 1 were assigned to the answer categories, 5 being given to strongly agree. The same values in reverse order were assigned those considered more autocratic.

Samples of 100 responses from the three experimental groups were drawn at random and scored. Those of the 25 respondents obtaining the highest and those from the 25 obtaining the lowest scores were used in item analysis. The items with low scale values were eliminated, the number retained being sufficient to insure that they could be administered in 50 minutes. Suggestions for revision collected at the time of administering the experimental scales were incorporated.

In the final form one scale consists of 14 questions concerning sources of income used for living expenditures; one scale of 4 questions concerning the purchase of durable goods; one of 3 concerned with savings and investments; and one of 8 concerning handling of money. Each question is followed by 19 or more items consisting of family members and, in a few instances, the method used.

Reliability for each final scale was determined by the split-half method. The coefficients of internal consistency found for Scales I, II, III and IV were .9743, .9383, .8717 and .9046, respectively, for the high school; .9596, .9358, .9343 and .9871 for the college group; and .9665, .8799, .9175 and .9353 for the adults.

Microfilm $3.50; Xerox $11.80. 269 pages.

FACTORS AFFECTING THE QUALITY OF ROASTED TURKEY

(L. C. Card No. Mic 59-1140)

Carriemae Garnes Marquess, Ph.D.
Iowa State College, 1958

Supervisors: Grace M. Augustine and
Agnes Frances Carlin

This investigation was undertaken to: (1) investigate the relation of three oven temperatures and two internal temperatures to quality and yield of cooked light meat and dark meat turkey rolls, (2) compare differences between roasted whole turkey and turkey rolls with respect to quality, yield, cooking losses, and portion control, and (3) determine the cooking time required for whole turkey and turkey rolls to reach specified internal temperatures.

Grade A, blast frozen, Broad Breasted Bronze, oven-ready tom turkeys weighing 20 to 22 pounds were used. In Part I, 24 were thawed, deboned, and shaped into light meat and dark meat rolls. Light meat rolls were dry roasted to 176 and 185°F. and dark to 185 and 194°F. at temperatures of 250, 300, and 350°F. In Part II, six birds were roasted whole and six roasted as light meat and dark meat rolls. At an oven temperature of 300°F., light meat rolls were dry roasted to 176°F., dark meat rolls and the thigh muscle of whole turkeys to 185°F. A trained panel of seven judges scored hot slices of light and dark meat for aroma, flavor, tenderness, juiciness, and degree of doneness.

No weight losses occurred during storage at -10°F. For turkeys thawed 72 hours, losses approximated 0.2 pound and for 96 hours, 0.25 pound. Based on as purchased weights, average percent raw breast muscles used in light meat rolls weighing 6.4 pounds was 26.5. In dark meat rolls weighing 2.8 pounds, thighs and backs used averaged 11.4 percent.

Cooking time, total and minutes per pound, varied inversely with oven temperatures. The difference was greater between total cooking time of rolls roasted at oven temperature of 250 and 300°F. than between those roasted at 300 and 350°F. Minutes per pound cooking time were

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

1.67 for light and 4.0 for dark meat rolls times those for whole turkey.

A recording potentiometer was used and temperatures were recorded for six points with each turkey roll at 15 second intervals. Data obtained indicated that there was a more rapid rise in temperature of dark meat of both whole turkeys and rolls than in light meat of both whole turkeys and rolls.

In general, as temperatures increased, percent yields decreased. Analysis of variance indicated that the linear effect of oven temperatures on yield of light meat rolls was highly significant while there was no significant difference in yield of dark meat rolls. Percent yields from cooked breast, thigh and back meat of whole turkeys and rolls were similar. Whole turkeys (minus giblets and neck) weighing 19 pounds yielded 35 percent cooked sliceable meat.

Total cooking losses for light meat rolls were affected significantly by ovens, oven temperatures, and interactions between these, and also by the degree of doneness, whereas dark meat rolls were not affected significantly by the treatments used.

In the opinion of judges, samples of light meat and dark meat rolls were more uniformly done than those from whole turkeys although all samples were considered satisfactorily done.

Flavor of light meat rolls cooked at 250°F. was more intense than that of rolls cooked at 300 or 350°F. No significant differences were found in aroma, flavor, tenderness, or juiciness of dark meat rolls. As determined by the quality factors evaluated in this investigation, there were no significant differences between turkeys roasted whole or as rolls. Microfilm $2.45; Xerox $8.60. 187 pages.

RELATIONSHIP OF SPACE IN HOUSING TO ATTITUDES TOWARD FAMILY LIFE

(L. C. Card No. Mic 59-134)

Mignon Perry, Ph.D.
Cornell University, 1958

The study tests the assumption that there is a relationship between the amount of space in housing occupied by the various individuals in the family and their attitudes toward family life. The attitudes of husbands and wives toward the aspects of family life, important to the integration of the family group and to the development of the individual members, were used as indicators of the effectiveness of the family unit. A theoretical model concerning the relationship is described.

The three spatial aspects of housing studied were: 1. building type (i.e., apartment and the single family house), was used as the measure of the amount of space surrounding the dwelling unit; 2. an interior density ratio (i.e., the number of persons per room), was used as the measure of the adequacy or inadequacy of space for the number of persons living in the house; and 3. the number of stories was used as a measure of structural design or the arrangement of space within the dwelling unit.

These measures of space were considered in relation to attitudes toward the family spending time together, the family spending its leisure time at home, entertaining as a family unit, and various aspects of privacy. Statements which indicated the attitudes of parents toward parent-child relationships were also included. The frequency of entertaining, the number of common interests of husbands and wives, the extent of agreement between husbands and wives on some value statements, the number of neurotic symptoms listed by the respondents, satisfaction with the house and its location, and an expression of a need for calmness and orderliness in the house were also studied in relation to the spatial aspects of housing.

Certain factors, such as education, profession, income, age and sex of the respondent, and the number and age of children were also considered as possible influences on attitudes. The first three were combined in a measurement of socio-economic status. This measurement, together with family composition and the sex of the respondent, were major intervening variables. The population was also divided into three groups representing the length of time the families had lived in their present residence in order to have an indication of any change in attitudes resulting from a change in housing situation. Responses from 1032 husbands and the same number of wives were analyzed by cross tabulating the main variables with each of the sub-groups. Chi square was used as a test of significance.

The results indicate that attitudes toward different aspects of family life are related to various situational factors, such as housing, socio-economic status, and family composition. Spatial inadequacies in housing seem to be related to attitudes toward the family spending time together and the patterns of entertaining. There is also some indication that inadequate housing is related to evidences of stress and strain.

Differences in responses of apartment and single family house occupants seem to be associated with the particular situation. Those in apartments want housing which will satisfy some of the needs not being met at the present time. Those in single family houses respond to the statements according to the way in which they made recent housing choices. There were no differences in responses based on the unit design (i.e., one and two story dwellings).

There is repeated evidence of different attitudes among the same and different status groups. Different attitudes appear in the low status group who live in single family houses. Part of this group, the ones who live in spacious housing, respond to the statements the same as the middle status group. Those who live in inadequate housing are not concerned with orderliness in the house, they object to having teenagers' bedrooms near theirs, they do not object to kitchen noises being heard in the living room, and they do not want room for recreation in their home. Additional research is indicated to determine other related factors.

Microfilm $3.80; Xerox $12.80. 293 pages.

GUIDES FOR EVALUATION OF MASS-PRODUCED STORAGE UNITS AND COUNTER SPACE IN HOME KITCHENS

(L. C. Card No. Mic 59-1142)

Mary Smith Pickett, Ph.D.
Iowa State College, 1958

Supervisors: Elizabeth Beveridge and
Margaret I. Liston

Consumers need information which helps to integrate facts and principles from physical and social sciences and guides them in making wise choices relative to mass-produced storage units and counter space. Such a need prompted the writer to design the present study to interpret the social potential of guides for choice of mass-produced storage units and counter space and to develop guides that may be used by builders and consumers.

Three distinct research methods were used, the logical method or interpreting the social potential of guides for choice; and both the survey and experimental methods to evaluate standards of the Illinois Small Homes Council score sheet and features of mass-produced storage units and counter space. The social potential of guides for choice was developed from principles of social psychology and economics. By social-psychological principles, the values and goals of consumers were interpreted as they operate in decision-making and guide behavior. Principles of economics provided criteria for interpreting the efficiency of resource allocation when choices are made relative to mass-produced storage and counter space.

Survey data relative to existing amounts and qualities of storage and counter space in the kitchens and information on the preferences of the homemakers for more counter and/or storage space were obtained from 87 homemakers in the city of Ames, Iowa. The sample was drawn by the Iowa State College Statistical Laboratory from records of the Story County assessor as to the single-dwelling permits which had been issued during the period, January 1950 to January 1954. From the experimental phase of the study, information was obtained relative to amounts of counter and storage space needed in the mix area of the kitchen for the preparation of meals for a family of four. Space requirements were determined when mass-produced storage units were located in three arrangements.

Evaluation of the Illinois Small Homes Council score sheet resulted in the recommendation that the following optimums be studied further:

1. base cabinet frontage, 12 feet to 13 feet 6 inches
2. wall cabinet frontage, 9 feet
3. counter at left of sink, 3 feet to 3 feet 6 inches
4. counter at right of sink, 3 feet to 3 feet 6 inches or 3 feet 6 inches to 4 feet
5. counter adjacent to range, 2 feet
6. counter for mixing, 3 to 4 feet

Other aspects of the study indicated that (a) recommended optimums should be the function of storage units which have been designed for storage purposes, (b) adequate counter space was not always accompanied by adequate storage. Counter space required for preparation of test meals averaged 15 inches depth (front to back) and 36 inches linear measurement, and (c) features of mass-produced storage units should be chosen in terms of their advantages and limitations to the consumer.

Microfilm $2.00; Xerox $6.00. 121 pages.

PHYSIOLOGICAL RESPONSE OF SPRAGUE-DAWLEY IMMATURE MALE WHITE RATS TO DIETS CONTAINING PEA BEANS SUPPLEMENTED WITH WHEAT, DL METHIONINE AND L LYSINE

(L. C. Card No. Mic 59-417)

Martha Elda Purdom, Ph.D.
The Ohio State University, 1958

A study was made of the effect of supplementation of pea beans with either wheat, D L methionine and L lysine HCl or a combination of these on weight gains, nitrogen retention, and deposition of nitrogen and lipids in livers of young rats. Egg protein was used as the standard.

Sprague-Dawley immature male albino rats ranging in weight from 60 to 80 grams were used as experimental animals. The rats were housed in individual metabolic cages and daily fed weighed (10-15 grams) quantities of experimental diets for a period of 28 days. The basic diets were composed of 10 per cent dietary protein from dried whole egg (fat extracted), pea bean or 6 per cent pea bean + 4 per cent wheat. Other dietary constituents included 5 per cent corn oil, 2.2 per cent vitamin mix, 4 per cent Wesson salt mixture W, and Cerelose (D-glucose) to 100 per cent. Synthetic amino acids, 0.3 per cent D L methionine, and 0.25 per cent L lysine HCl were incorporated into the diets at the expense of Cerelose. The diets were fed to nine groups of six rats for an interval of 28 days.

For evaluating the growth-promoting quality of the diets, rats were weighed at a specified time twice a week. Scattered and uneaten food was collected, dried at room temperature, and weighed. This weight was subtracted from that offered to determine the total amount of food consumed.

To estimate biological availability of the dietary protein, four composite 7-day urine and feces collections were made for individual rats during the 28-day study. Total nitrogen was determined on each of the nine diets, feces, urine, and individual rat livers by the boric acid modification of the macro-Kjeldahl procedure. Calorie contents of diet samples were estimated by direct combustion in the Parr Oxygen Bomb Calorimeter and were found to be essentially isocaloric.

The animals were sacrificed (using ether) at the end of 28 days. The livers were removed, blotted on absorbent paper, and wet weighed. They were kept frozen in sealed, air-tight, small glass bottles until analyzed. They were dried at 50°C. to a constant weight in a vacuum oven, and the percentage of moisture determined. The dried liver samples were weighed and extracted for 4 hours in Goldfisch fat extractors to determine lipid content.

The findings indicated that the average percentage of nitrogen retained per 100 grams of food consumed by individual rats was closely related to the amino acid balance of the dietary protein. However, weight gains and nitrogen retentions did not run parallel, which indicated that other factors were concerned in weight increments.

Supplementation of pea bean diets with methionine was more effective for increasing weight gain and nitrogen retention than supplementation of pea bean diets with wheat. Lysine supplementation of pea bean or pea bean + wheat diets slightly decreased weight gain and nitrogen retention. This indicated that pea bean or pea bean + wheat diets were primarily deficient in methionine and that lysine supplementation induced an imbalance of the existent partial deficiency.

Methionine supplementation of pea bean and pea bean + wheat diets increased hepatic tissue synthesis and maintained a normal lipid and nitrogen deposition in the livers of growing rats.

The egg protein diet was found superior to the supplemented pea bean or pea bean + wheat diets for weight gains, nitrogen retention, and normal lipid and nitrogen deposition in the livers of young rats.

Microfilm $2.00; Xerox $5.00. 97 pages.

FINANCIAL MANAGEMENT PRACTICES OF YOUNG FAMILIES

(L. C. Card No. Mic 59-454)

Helen Laverne Wells, Ph.D.
Cornell University, 1958

This study was an attempt to get a more comprehensive picture of how young families manage their finances, attitudes toward management of finances, and relationship between attitudes and practices.

Sixty rural families which had been established less than 10 years and in which the wife was under 31 years of age were interviewed in Tompkins County, New York, in 1957.

Interviews were held with husband and wife jointly to obtain information concerning assets and liabilities of the individuals at marriage and of the families at the time of the interview, current income and expenditures, financial management practices followed by the families since marriage and at the time of the interview.

A separate section concerning attitudes and practices and perception of role were filled out by husband and wife individually.

Median net worth for husbands at marriage was $1580; for wives, it was $1520; and for couples it was $3810. No couples had negative net worth at marriage.

At the time of the interview, total value of all possessions owned by the families ranged from $3100 to $94,633. Median amount of possessions was $20,000. Many families owed for house, furniture and household equipment, and automobile. Amounts owed ranged from $45 to $25,200. Median amount owed was $9000. Net worth of the families ranged from minus $2500 to plus $71,000, excluding life insurance. Median net worth was $10,000.

Net financial gain since marriage ranged from minus $4450 to plus $60,000. Median net gain was $6000.

Average net gain per year was $1565.

Annual income ranged from $1200 to $11,200. Average income was $5890.

All families spent money for food, insurance, clothes, and recreation. Food, housing, non-housing debt payments, and taxes accounted for more than one-half of the total expenditures.

In general, expenditure for all items increased with increasing income.

Median face values of life insurance policies owned by the families at the time of the interview was $15,500; for husbands it was $13,000. Eighty per cent of the families had an increase in the face value of their insurance from the time of marriage to the time of the interview.

All of the families except 1 kept some kind of financial accounts; about one-half of the families reported that they budgeted their income.

More of the families established less than 5 years budgeted, usually for learning reasons, than families established 5 years or more.

Families established 5 years or more did not keep accounts as frequently, kept more casual accounts, and kept accounts for income tax purposes, more than families established less than 5 years.

The families established longer and with higher incomes had more hobbies, took more, shorter, costlier vacations than the families established less than 5 years. They also paid to have more services done for them, made more money or material goods contributions to others, and received fewer money or material goods contributions from others. There was also a partial shift from "both" husband and wife making decisions to delegation of duties.

Over two-thirds of the wives worked before marriage and continued working for some time after marriage. Only 3 wives did not work before nor after marriage.

The paired couples were in high agreement on attitudes and practices, and generally agreed more on more important decisions than on less important decisions. They agreed most on skills that had been used by family members and least on the ranking of some values commonly considered important.

As a research method, the author considered the joint interview and separate individual questionnaire successful for this type of study.

Microfilm $4.15; Xerox $14.00. 324 pages.

LANGUAGE AND LITERATURE, GENERAL

THE "HISTOIRE CRITIQUE DES JOURNAUX" OF DENIS-FRANÇOIS CAMUSAT: AN EVALUATION AS A SOURCE FOR THE HISTORY OF FRENCH LEARNED JOURNALISM, 1665-1730

(L. C. Card No. Mic 58-7638)

George Brown Davis, Ph.D.
Brown University, 1958

The life of Denis-François Camusat (born, Besançon, April 30, 1700) was marked by two events: his first letter, April 19, 1719, to the French refugee, Pierre Des Maizeaux, in London; and his emigration to Holland late in April, 1731.

Camusat's early life is known only from legal documents in Franche-Comté public archives. Eldest son of an honored Besançon avocat and vicomte-maire, his later close connection with the Oratorian schools at St.-Claude and Poligny suggests that his early formal education was with the Oratorians in Besançon. Like many another eighteenth century youth, Camusat became an abbé without any vocation. His choice was probably a compromise between his love of literary scholarship and his father's demand that he choose a suitable état.

By his own admission, Camusat had early become fascinated with journals and had even conceived the idea of writing a history of them. The immediate stimulus to the actual composition of his life-work - the Histoire critique des journaux - was his discovery of Des Maizeaux's letter to Jacques Bernard, published by the latter in the Nouvelles de la république des lettres, in August-September, 1701. In it, Des Maizeaux called for a comprehensive history of journalism while materials were still available.

From 1719 until Camusat's death in 1732, his correspondence - principally with Des Maizeaux - is the unintentional diary of the growth of the text of the Histoire. In Paris, Geneva and Holland, Camusat is always gathering materials, compiling 'extraits', revising his text, printing, and reprinting trial chapters (1720, 1721) which he sends to Des Maizeaux for comment and criticism.

During this period, Camusat's main source of support, once he had ceased to be private librarian to the Maréchal d'Estrées in Paris, was as editorial hack and journalist. Camusat began the Mémoires historiques et critiques, the Bibliothèque françoise and the Bibliothèque des livres nouveaux. Later he also published the Lettres sérieuses et badines sur les ouvrages des savants. From 1726 to 1731, he published several volumes of memoirs and edited the poems of Chaulieu and La Fare for Dutch publishers. He also acted in some capacity as author's agent for the P. Le Quien and the Abbé de Vertot.

The new life which his emigration to Holland was to have afforded him was cut short by his premature death in dire poverty, October 28, 1732, in Amsterdam. In 1734, his usual Dutch publisher, Jean-Frédéric Bernard, published the Histoire critique des journaux in two volumes. The manuscript used was undoubtedly the latest revision upon which Camusat had been working at the time of his death. How Bernard secured it is unknown. Perhaps it was for debts owed to him by Camusat.

The Histoire critique des journaux (1734) is an invaluable collection of source materials. It allows us to study the naturalization of the concept of critical journalism into the framework of the learned world of the early eighteenth century. This concept will be of vital importance in the ultimate establishment of the Enlightenment. In the Histoire Camusat has transmitted to us many significant facts: the biographies of several obscure early journalists; the attitudes towards journals and the querelles d'auteurs of his day; a narrative of the struggle for the recognition of the concept of criticism during the years when the République des lettres was undergoing a metamorphosis into the Europe française.

The twentieth century scholar, seeking to further the needed inventory of eighteenth century French journalism, will find in no other contemporary publication so rich a mine of materials for evaluating the significance of journalism in the development of early eighteenth century thought as in the Histoire critique des journaux.

Microfilm $5.50; Xerox $19.20. 430 pages.

THE TIRESIAS TRADITION IN WESTERN LITERATURE

(L. C. Card No. Mic 58-7920)

Philip Ray Headings, Ph.D.
Indiana University, 1958

This study traces the figure of Tiresias, the blind prophet of Thebes, through Western literature from Homer's Odyssey to works of the twentieth century.

Chapter I examines five major classical works in which Tiresias appears: Homer's Odyssey, Sophocles' Oedipus Rex and Antigone, and Euripides' Bacchae and Phoenissae (plus Seneca's Oedipus and Nonnos' epic Dionysiaca). The characteristics of Tiresias in these works are his longevity and his transcendent wisdom--his stature as the infallible prophet and the wisest of humans, devoted to the will of the gods and the health of his community.

Chapter II endeavors to compile the numerous references to Tiresias scattered over a thousand years of Hellenistic, Latin, and Byzantine literatures, where the mythological emphasis is on Tiresias' sexual transformations and resultant gifts, and his judgement in the argument between Zeus and Hera regarding the question whether man or woman derives more pleasure from sexual intercourse. This chapter details the evidence of Tiresias' omnipresence in the classical consciousness.

Chapter III considers the interpretation of myths in

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

general and the Tiresias myths in particular, drawing on several modern theories and suggesting the value of Tiresias as a symbol of the goals of man's psychic development.

The long span from Dante (in Inferno XX) to the nineteenth century is covered in Chapter IV, with major emphasis on Matthew Arnold's poem "The Strayed Reveller" and Swinburne's longer poem "Tiresias," which has strongly influenced T. S. Eliot's later use of Tiresias.

"The Mythological Tradition in the Twentieth Century" analyzes Apollinaire's surrealist farcical drama Les Mamelles de Tirésias and T. S. Eliot's The Waste Land, both of which return to the figure of Tiresias as the man-woman in close touch with the most potent forces of life. Each also attempts with considerable success to cut beneath the limitations of conventional esthetic techniques.

Chapter VI returns to the literary tradition as it appears in three twentieth century tragedies: Hofmannsthal's Ödipus und die Sphinx, Gide's legend play OEdipe, and Cocteau's La Machine infernale. Hofmannsthal elevates the Tiresias of Sophocles to his highest eminence in dealing with a previously untreated segment of his career; Gide questions for the first time the integrity and potency of the seer; and Cocteau handles the figure of Tiresias in ways which add up to almost total rejection of what he has stood for in his entire tradition.

The conclusion finds a certain coherence in the tradition as a whole, but insists on canvassing its widely divergent strands, which have left the figure a prominent place in twentieth century works, without, however, any concord of interpretation.

Microfilm $2.95; Xerox $10.20. 226 pages.

THE AUTUMN OF STRANGE SUFFERING: AN INTERPRETATION AND CRITICISM OF SHELLEY'S ALASTOR

(L. C. Card No. Mic 59-166)

Parks Caldwell Hunter, Jr., Ph.D.
The University of Texas, 1958

Supervisor: Willis Winslow Pratt

More criticism per line has been written about Alastor than about any other poem of Shelley's; much of this criticism, however, concentrates upon the sources of the poem and has appeared in articles of necessarily restricted scope. Since the interpretations of Alastor are controversial, the comprehensive interpretation must relate to all that Shelley has written. In this thesis, the interpretation has been obtained from considering Alastor not only by itself but in the context of Shelley's letters, his prose, his poetry, and his place in the milieu of Romanticism. Also, all of the major criticism of Alastor has been analyzed and evaluated.

Reconciling the poem to its Preface becomes the critic's main problem when the poem is considered by itself (Chapter I). In the poem the Poet's actions are determined. In the second paragraph of the Preface, the element of choice modifies Shelley's philosophy of determinism and identifies the crucial stage of his development as a poet. Here Shelley presents explicitly the doctrine of sympathy for mankind to follow. In the poem Shelley subordinates every other feature of poetry to the feeling for the Poet which will presumably establish empathy of the readers with their fellow men. Nevertheless, Shelley needs the Preface.

Besides explaining essential symbols and images found in Alastor, Shelley's letters enunciate his doctrine of sympathy and reveal the distinction between pleasure and happiness that helps to clarify the poem and the Preface (Chapter II). This modest creed of Shelley's is dominant in every one of his important poems; knowledge and sympathy combine to produce perfection. Subscribing to empiricism in his letters, Shelley thinks that sympathy extends the range of man's ideas, gives him knowledge of remote causality, and promotes a continuously improving state of perfection. The negative life of the Poet in Alastor represents this philosophy, as does the positive statement in the Preface.

The four prose works most closely connected to Alastor are "The Assassins," "Essay on Love," "A Defence of Poetry," and "Una Favola." The doctrine of sympathy dominates each work. The ideas, images, and symbols seminal in Alastor develop more maturely and explicitly in the prose. "Una Favola," probably the long neglected prose complement of Epipsychidion, duplicates the allegory of the Poet; the Youth exerts his superhuman powers of knowledge unsuccessfully and must return to Nature to reintensify his sympathy that he may achieve perfection.

The four important poems most closely connected to Alastor are The Revolt of Islam, "Prince Athanase," Prometheus Unbound, and Epipsychidion. Again sympathy dominates, and again the important components of Alastor amplify themselves and in retrospect clarify the poem. Significantly, Shelley requires no other poem of his to bear so heavy a load of symbolism as he has required of Alastor.

Alastor's probable connection with parts of Coleridge's The Friend orients Shelley in the milieu of Romanticism (Chapter III). Shelley probably takes his "good die first" quotation from The Friend, as well as ideas contained in issue No. 17 by John Wilson (Mathetes), in Coleridge's answer, and in Nos. 20 and 25 by Wordsworth. Keats's Endymion has been compared with Alastor and found to complement rather than answer the earlier poem and to be indebted to the common heritage of Romanticism rather than specific parts of Alastor. The faults and misinterpretations made by critics of Alastor result from a neglect of the contextual relationship of the poem to the rest of Shelley's work (Chapter IV).

Microfilm $5.65; Xerox $19.80. 442 pages.

THE CONVENTION OF REVOLT: ORIGINS OF THE RENAISSANCE REALISTIC LYRIC

(L. C. Card No. Mic 59-735)

Harry Levtow, Ph.D.
Columbia University, 1958

This study deals with a current in western European lyric poetry during the Renaissance and Middle Ages which departs in both content and style from the conventional courtly, Platonic and Petrarchan lyric which dominated the periods. Called "realistic" in the accepted literary sense, this current is oriented toward sensuality, satire and

the grotesque, exhibiting generally an aggressive psychological tendency, in contrast to the submissiveness and idealism of courtly love and Petrarchan poetry.

An attempt is made to show that the movement was much more than a mere reaction to idealistic verse, as it has generally been considered in treatments of sixteenth century "antipetrarchism"; in fact, a widespread, conscious art tradition with a conventional subject matter and rhetoric of its own. It runs parallel with the main stream of idealistic verse and most poets write in both traditions, exhibiting a dualism rather than the idealism alone usually ascribed to them. Realistic verse stems from certain genres of troubadour poetry elaborated by early Italian poets, as does idealistic verse.

To the subtle, conceited and rich style of idealistic poetry, realistic verse opposes directness and plainness, even rudeness, of diction. Its content falls into well-defined categories: epicureanism; praise of sexual fruition and inconstancy; attacks on the foolishness and insincerity of idealistic verse; recantations and attacks on love and women; descriptions of women as ugly; and vituperation and ribaldry. In contrast to the typical subjective monologue in which idealistic verse is cast, the realistic tradition often uses objective dramatic forms, including dialogue genres and dramatic monologues.

The Introduction defines the term realistic and illustrates this type of poetry by examples from sixteenth century French and English poets from Marot to Donne. Succeeding chapters treat, first, the concept of genres and styles among the troubadours, with examples of some of the realistic poems found among them. There follows a detailed account of realistic poetry among the early Italian poets, followers of the troubadours. Among those considered are: the "Sicilian School"; anonymous authors of contrasti, or dialogue seduction poems; "realistici" such as Rustico di Filippo, Cecco Angiolieri, and other minor figures preceding and contemporary with Dante; and poets of the later Trecento, with special emphasis on poetry for music, such as the madrigal and ballata, as exemplified in the works of Franco Sacchetti and others.

Microfilm $3.15; Xerox $10.80. 241 pages.

THE UNCOLLECTED STORIES OF JAMES KIRKE PAULDING: AN ANNOTATED EDITION (VOLUMES I - III)

(L. C. Card No. Mic 59-170)

Melvin Rosser Mason, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Philip Graham

The present edition collects seventy-three of James Kirke Paulding's stories not included in either his books published during his lifetime (1778-1860) or in those edited later by his son, William Irving Paulding. The text is taken from nineteenth-century American periodicals and gift books.

A prolific writer, Paulding produced many different types of stories, some of which reflect his own literary theories. He urged Americans to write fiction with American backgrounds, and he followed his own preachment, particularly in his stories involving the New York Dutch. On the other hand, many of his moral stories are set in the Far East. Objecting to supernatural elements of romanticism, he urged Americans to write "rational" fiction, keeping action within the realm of probability. Many of his own stories employ "ghosts" or other mysterious phenomena that are rationally explained. Other stories, though, are light-hearted fantasies that contradict his theory. Of his didactic stories, a few are fables and allegories; many are satires.

Paulding's environment furnishes the basic themes for his stories. These reveal his nationalism, anti-romanticism, and rationalism, along with his belief in the beneficial effects of industrious employment and of rural (as opposed to urban) living conditions. He satirized the travel vogue, spiritualism and phrenology, social extravagance, reform movements, and government-sponsored internal improvements.

Paulding often re-worked published materials to get new stories, particularly in the case of the moral Eastern tales. The same character types occur over and over in his writing. Poor planning, digressiveness, lack of unity, and preoccupation with volume of copy account for the weakness of many of the stories.

During Paulding's lifetime the short story began to emerge as a distinct genre. His greatest contribution to that development was his use of native materials. He experimented with point-of-view and time. Some of his more original characters and plots are in stories that deal with mental or psychological problems as well as physical conflicts.

Although there has been something of a revival of scholarly interest in Paulding, little work has been done with his uncollected stories. The present collection may enable scholars to make a more comprehensive survey of Paulding's writings and to determine his proper place in the overall picture of American literature.

Microfilm $16.45; Xerox $59.20. 1313 pages.

THE ART OF LEAVES OF GRASS: A CRITICAL ANALYSIS OF THE FINAL TEXT, WITH PARTICULAR ATTENTION TO IMAGERY, SYMBOLISM, AND STRUCTURE

(L. C. Card No. Mic 58-7927

John Thayer Ogilvie, Ph.D.
Indiana University, 1958

This study undertakes to examine and evaluate Whitman's Leaves of Grass not as a biographical or historical testament, or as versified philosophy or religion, but as a work of conscious literary art. The governing assumption is that Whitman, at his best, is a poet of considerable resources and sophistication and that his work deserves to be treated tolerantly and carefully in aesthetic-critical terms. Analysis is focused throughout upon the elements of imagery, symbolism, and structure, since Whitman's distinctive interest and strength as a poet are seen as centering here. The text scrutinized is that of the final (1892) edition, although reference is occasionally made to variant readings and differing arrangements in earlier editions.

The governing plan of the study is intended to be both simple and efficient. Chapter I proposes the general topic of Whitman as a literary craftsman. Chapters II ("A Poetry of Things") and III ("The World of Leaves of Grass") attempt to isolate the basic aesthetic principles and tendencies underlying Whitman's poetry and to establish the essential characteristics of Leaves of Grass as an imaginative creation. In Chapters IV-VIII detailed attention is given to those poems and groups of poems which, taken together, constitute the 'indispensable' Leaves of Grass: "Song of Myself," Children of Adam, Calamus, "Crossing Brooklyn Ferry," "Out of the Cradle Endlessly Rocking," "As I Ebb'd with the Ocean of Life," Drum-Taps, and "When Lilacs Last in the Dooryard Bloom'd." ("There was a Child We t Forth" and "The Sleepers" are treated in the first part of Chapter III.) Chapter IX ("Leaves of Grass in Retrospect") summarizes the conclusions that have emerged and speculates briefly about them. The central aim of the study as a whole is to provide a unified view of Whitman's artistry and of Leaves of Grass as an aesthetic entity. Extensive use is made of pertinent primary and secondary sources.

The main conclusion reached through these analytical explorations is that Whitman's best poetry represents a remarkably high level of artistry, characterized by the employment of a flexible and thoroughgoing symbolistic technique (the method of "Indirection"), by the deft manipulation of meaningful patterns of imagery, and by the presence of enforcing structural frameworks. It is further evident that these literary procedures are not at all haphazard in their formulation but reflect clearly articulated poetic theory, which in turn derives from Whitman's Transcendental metaphysics. Whitman emerges as fundamentally a symbolistic-metaphysical poet, rather than as a "national" poet, a "mystic," or something else. His "paradox" of the oneness of Matter and Spirit is seen as being the generating core of all of his poetry. Other central considerations coming out of this study involve: the key position of "Song of Myself" as a germinal source of attitudes and techniques; the distinction-dissolving illusionism of Whitman's poetry; the definition of recurrent terms and image-symbols; the dominating device of the dramatized symbolic Self; and the establishment of consistent aesthetic criteria.

Microfilm $4.00; Xerox $13.60. 311 pages.

THE AMERICAN SHORT STORY 1865 - 1885

(L. C. Card No. Mic 59-742)

John Henry Roch, Ph.D.
Columbia University, 1958

The period 1865 to 1885 was crucial in the development of the American short story. Since the work of Hawthorne and Poe had not greatly influenced their immediate followers, the postwar writers had to rediscover some of the principles and forms of the short story.

This dissertation is a study of all the short stories published during these years in the Atlantic Monthly, Scribner's Monthly, Century, Galaxy, and Harper's Monthly. Because there were few great short story writers during the period, the emphasis is on important trends rather than individuals. The significant achievements in the short story include the more frequent treatment of contemporary subjects, the tightening of the form, the effective use of humor and satire, the development of the local color story, and the introduction of realism. The exploitation of sentimentalism, of course, continued through the period although more and more writers reacted against it.

In their treatment of contemporary ideas and events, the writers were not very daring, but there were not content with the love idyls of the lady's books and annuals. They frequently dealt seriously with the problem of racial minorities. They also reflected on the changes wrought by the Civil War, often regretting the loss of innocence and simplicity in American life. Concerning religion the writers were conservative, but they occasionally noted the reaction against puritanism. The international short stories of Henry James and others compared American life with that of older societies.

In form the short story developed slowly but steadily during the period. From the sprawling, essay-like stories of the fifties and sixties, the short story evolved into a relatively definite literary genre. The writers abandoned the old condensed novel type of story by limiting more strictly time and action. They took care to present the story to the reader in a plausible way. Generally these writers tended to meet Poe's demand for unity, brevity, and compression.

Sentimentalism persisted through the period, even in the better magazines. Avoiding the harsh realities of contemporary life, the sentimental stories were mostly optimistic and provided simple solutions for the problems of their idealized characters. Their main significance in this study is that they reveal the weaknesses and excesses that the realistic writers were reacting against.

Closely related to each other in the history of American literature, humor and local color were part of the reaction against sentimentalism, although the local color story was certainly not devoid of sentimentalism. Humor was often used to ridicule the emotional excesses of sentimental fiction. Local color, like realism, stressed accurate and detailed description of scenes and characters and emphasized peculiar rather than universal qualities. Although they later became distinct, local color and realism grew up together, aided by the same social and literary conditions.

Without doubt the realistic writers made the most significant contributions to the short story during the period. Although their realism was extremely limited, their acceptance of the responsibility to report life accurately had an important influence on American literature. They tried to create characters who corresponded to real people and to provide plausible motivation for these characters. They avoided the extreme style of the sentimentalists and the oversimplified solutions to the problems of their characters. In fact, most of the significant changes in form and content are apparent in the realistic short story. Although generally damned by critics as genteel and timid, the pioneer work in the short story during this period helped make realism one of the important strains of American literature. Microfilm $3.95; Xerox $13.40. 306 pages.

LANGUAGE AND LITERATURE, CLASSICAL

CYRIACUS OF ANCONA AND ATHENS

(L. C. Card No. Mic 58-7822)

Rev. Edward W. Bodnar, S.J., Ph.D.
Princeton University, 1958

Cyriacus of Ancona (ca. 1391-ca. 1455) is often the only witness to the existence, form, and content of a classical Greek inscription. It is of utmost importance to the epigraphist who edits these documents and to the historian who uses them as evidence to know how reliable the testimony of Cyriacus is.

In order to make some progress towards solving this problem, a detailed study of a small and manageable group of Cyriacan inscriptions was chosen, the fifty-two which he copied in Athens. Of these, twenty-two are extant, at least in fragments, and the squeezes of most of them were available for consultation. But first, one had to determine, if possible, precisely what Cyriacus wrote when he copied each of these inscriptions into his book, the Commentaria. And, since the book, except for a small fragment which does not pertain to the inscriptions in question, is lost, it was necessary to examine the manuscript tradition in as far as it contains these inscriptions and to set up a hypothetical stemma. Also, as a backdrop to this technical discussion, it was useful to reconstruct Cyriacus' itinerary and the general character of the book which he kept. This could best be done by direct citation from those parts of the Commentaria which we have, at least in copies.

It is evident from a comparative study of the manuscripts involved that the section of the Commentaria which dealt with the journeys through Dalmatia and Greece in 1435-1437 was copied not long afterwards by someone who changed the dated, personal, diary-style entries into undated, impersonal, guide-book-style descriptions (X^1). A little later, when the section with which we are concerned was somewhat disordered and confused with another section, it was copied again (X^2). This time, the dated, personal, diary-style was left intact, but most of the sketches were omitted.

In addition, there is a whole tradition of excerpt-type manuscripts which seem to depend ultimately on a set of excerpts from the Commentaria for 1435-1437 which were made by Cyriacus himself (Mommsen's Antiquum Venetum).

Of the fifty-two Athenian inscriptions, only fourteen (nine of which are still extant) have a multiple text-tradition. The copies of the others can be traced back no farther than X^1 or X^2. Although Cyriacus' readings in these fourteen inscriptions are in the main accurate enough, a substantial number of errors can be with certainty attributed to him. Other errors can be blamed on the writer of X^2, but a considerable number of mistakes may be due either to Cyriacus or to the writer of X^2. The accuracy of the writer of X^1 is not easily determined, since the evidence is too scanty. It follows that the epigraphist should be very circumspect in accepting the readings of Cyriacus, even where they can be ascertained, and that greater caution must be used where our only text is that of X^1 or X^2. In the matter of line-division, the division used by Cyriacus can seldom be discovered, since the manuscripts disagree, but when we can discover it, it is usually wrong. In most cases we cannot go beyond X^1 or X^2, which, where the divisions can be checked against the stone, are rarely correct. But in no instance have we found the Greek inscriptions among this group of Cyriacana to be fraudulent. When Cyriacus says that he saw a given text in a given location, we may believe him: only we must not rely on his line-divisions and we must be cautious in accepting individual readings. Microfilm $3.95; Xerox $13.40. 306 pages.

APPIAN'S EXPOSITION OF THE ROMAN REPUBLICAN CONSTITUTION

(L. C. Card No. Mic 58-7861)

T. James Luce, Jr., Ph.D.
Princeton University, 1958

This dissertation attempts to describe in what special ways Appian, as opposed to his sources, tried to present the Roman Republican constitution to his Greek readers of the second century A.D. Three areas are investigated: 1) constitutional terminology, 2) asides or explanations concerning the Republican constitution, and 3) what factors determined Appian's inclusion, exclusion, and emphasis of source material. The general conclusions are these: 1) Appian tried to make his constitutional terminology intelligible per se in Greek; he shows overwhelming preference for words descriptive of function rather than for conventional titles, which of themselves carry little meaning. 2) His explanations of constitutional principles are brief, derive from various sources, and are often ineptly inserted into the running narrative. 3) Appian's selection, omission, and emphasis of source material were largely based on: a) his own interests, b) his purposes in writing, and c) the interests, knowledge, and abilities of his intended reading public. These, in turn, are briefly as follows: a) His own interests centered principally around oratory, legal matters, comparisons and contrasts, and governmental administration. b) His purposes in writing were chiefly: to illustrate the peace, prosperity, and well-being of the Empire by contrasting it with the civil strife and bloody anarchy of the later Republic; and to describe the evolution of the Empire out of the Republic, especially the precedents and nature of monarchical rule. c) The many asides on common Roman customs, the factual and circumstantial narrative, the simple, straightforward language all testify that his intended reading public were common people of no great sophistication who knew little about Roman affairs; in his selection of material Appian tried to cater to their knowledge, interests, and wants.

The dissertation has the following outline. Chapter One is a discussion of Appian's life and character. Chapter Two concerns his treatment of citizenship, and of social and political distinctions. Chapter Three deals with Appian's presentation of the various magistracies and magistrates. Chapter Four discusses the Senate and the assemblies. Chapter Five, entitled "The Republic and the Empire", treats Appian's emphasis on the Republican precedents of imperial institutions, especially of one man rule: included in this last section is his treatment of the dictatorship, the triumviri rei publicae constituendae, extraordinary careers, the early kings, and the Roman emperors. Finally, judgment is made on Appian's working methods and on his own knowledge of the Republican constitution. Microfilm $2.20; Xerox $7.60. 165 pages.

STUDIES IN THE CARMINA LATINA EPIGRAPHICA

(L. C. Card No. Mic 58-7900)

John William Zarker, Ph.D.
Princeton University, 1958

This study is divided into two parts. The first part is concerned with the corpus of Latin verse inscriptions established by F. Bücheler and E. Lommatzsch. (Carmina Latina Epigraphica, Pars Posterior of A. Riese, Anthologia Latina, Fascs. I-III. Leipzig 1895, 1897, 1926.) Chapter I demonstrates the existence of rime and its extent in the verse inscriptions; the relationship of verse inscriptions to classical verse and to medieval verse in regard to rime is suggested. Chapter II discusses briefly the background of the acrostic in classical Latin literature, examines in some detail the characteristic features of the acrostic in the Carmina Latina Epigraphica, and suggests the transition of the acrostic into medieval Latin verse. Chapter III begins with a survey of the Roman tradition of occasional verse composition, involving both literary and epigraphic poems. The canons of writers of occasional verse are presented to suggest the existence of an anthology of verse inscriptions. In the second section of Chapter III, the evidence for authorship in the poems themselves is studied in light of the epigram itself, the occasion, and the profession and status of the author. One interesting facet of this study is the relationship of master and slave, patron and freedman in regard to the composition of verse inscriptions. The third section contains an investigation of similar epigrams and formulae. One epigraphical formula, "abstulit atra dies et funere mersit acerbo," (Ver. Aen. 6.429; 11.28) is studied in detail; the study reveals both the appropriateness of its use and the great number of variations of form in the use of the formula. The final section of Chapter III presents the theories of scholars, including this author, concerning authorship, composition, originality, and transmission of verse inscriptions.

The second part of the study is a collection of those Latin metrical inscriptions, accessible to this author, that have appeared since the edition of Lommatzsch in 1926. The collection contains primarily pagan inscriptions ranging from the earliest times to about the fifth century A.D. Christian verse inscriptions have been included, as in the editions of Bücheler and Lommatzsch, for the sake of comparison. These epigrams are arranged in chapters by meter. To each of the 182 inscriptions are appended appropriate bibliography and statements concerning place of find, date, location of photograph or facsimile, present location, and other similar information. A brief line by line commentary presents information of literary, epigraphical, and historical interest. Indices of the Initia Carminum and Titulorum Nomina Propria are included.

Microfilm $3.80; Xerox $12.80. 293 pages.

LANGUAGE AND LITERATURE, LINGUISTICS

GRAMMATICAL STRUCTURES IN AMERICAN INTONATION

(L. C. Card No. Mic 59-123)

William Whitney Gage, Ph.D.
Cornell University, 1958

This work is a trial formulation for a grammar of intonation analyzed according to the methods employed elsewhere in contemporary American structural linguistics. Intonation is here understood as the meaningful use of pitch in English. Also included (Chapter 2) is a treatment of the grammar of stresses on the level of units no smaller than those which can stand as independent words.

The main development proceeds from a consideration of the phonological elements required to describe intonation (Chapter 1) through the structure of intonation patterns in terms of arrangements of these (Chapter 3), the meaningful units in intonation patterns (Chapter 4), the coupling between patterns involved in the formation of larger syntactic constructions (Chapter 6), and finally (Chapter 7) the relation between intonation and conventional grammatical structure.

The fifth chapter treats certain elements--for example pauses--which are peripheral to the main body of the system of American English intonation.

Appendices include: (A) a list of technical terms with special uses in this work; (B) a list of the morphemes found; (C) brief texts treated according to the system developed in the body of the treatise; (D) notes on the insufficiency of the four-pitch-level scheme used in this work; (E) notes on the accoustic characteristics of phrase terminations. Microfilm $2.00; Xerox $6.60. 137 pages.

EARLY NORTH CAROLINA PRONUNCIATION

(L. C. Card No. Mic 59-57)

Edward Almand Stephenson, Ph.D.
The University of North Carolina, 1958

Supervisor: Norman E. Eliason

The primary purpose of this study is to reconstruct the sounds of North Carolina speech in the 18th century and to determine the pronunciation of as many individual words as the evidence will permit. The achievement of these aims is sought by analysis of occasional spellings gathered from 165 collections of North Carolina manuscripts, preserved in the Southern Historical Collection of the University of North Carolina library.

The historical approach is used. The words are classified according to their Middle English forms, the sounds are viewed within the frame of reference of the transition from Middle English to Modern English, and a rationale is offered for every significant pronunciation indicated by the spellings. The study also provides a generous sampling of parallels between North Carolina pronunciations and those of other dialects, British and American. These comparisons serve to suggest the mixed character of North Carolina

speech in the 18th century and to throw some light on its origins.

Examination of the treatment of consonants, which is first undertaken, reveals a considerable variety of forms, with several pronunciations of the same word often contending for supremacy. North Carolinians of the period, even cultivated persons, often dropped and added or voiced and unvoiced consonants in a way that would be considered slipshod today. Hypercorrect pronunciations, as seen in linning 'linen,' are also evident. A loss of postvocalic [r] was in progress, but the direction of spread is not apparent.

The stressed vowels are next considered. The main affiliations of early North Carolina speech in this respect prove to have been with 17th-century British Standard English, although occasional influences of British regional dialects are detectable in the spellings. The sounds of the vowel phonemes were no doubt in most instances much the same as they are today in North Carolina, but in the use of certain phonemes in certain words or classes of words a considerable amount of redistribution, both social and geographical, has evidently occurred since the 18th century. And some pronunciations then used have passed out of existence or survive only as relic forms in isolated areas, such as those indicated by the spellings clark, marchant, and the like. Again, diverse methods of pronouncing particular words can be inferred from the spellings.

In the selection of unstressed vowels, which are taken up last, North Carolinians in the 18th century had already established, or very nearly so, the present Southern modes of pronunciation in initial and final syllables, breaking away from British practice in this matter. Some aphetic forms (initially) and some hypercorrect forms (finally) were also used. In medial syllables, where American English has now standardized [ə] between consonants, both [ə] and [ɪ] were competing actively in North Carolina. Examples of syncope and syneresis, moreover, abound in the manuscripts.

The present cleavage in pronunciation between the eastern and western parts of the state had not developed in the 18th century, or was only incipient. The picture that emerges from the spellings is one of marked diversity in both parts of the state with neither section having any characteristics that conspicuously distinguish it from the other. Furthermore, when the North Carolina spellings are compared with those in 17th-century Massachusetts town records, a similar inference must be drawn. Both states exhibit great diversity, with the same variations cropping up again and again. There were colonial modes of pronunciation, but as yet no distinctly Southern dialect.

Microfilm $4.05; Xerox $13.80. 316 pages.

LANGUAGE AND LITERATURE, MODERN

LITERARY CRITICISM IN GERMAN PERIODICALS OF THE EIGHTEEN-SEVENTIES

(L. C. Card No. Mic 58-7903)

Erwin Rudolph Behrendt, Ph.D.
Indiana University, 1958

Chairman: Dr. Norbert Fuerst

This dissertation investigates the literary criticism in some representative German periodicals of the decade 1870 to 1880. This period was chosen, first, because no detailed evaluation had been made of its literary criticism so far as the periodical literature is concerned; second, because it is a decade of intrinsic interest, the last decade before Naturalism. The subject matter as well as the documentation is limited to the following five journals of the 1870's available at the Indiana University Library: Baltische Monatsschrift, Deutsche Rundschau, Die Gegenwart, Preussische Jahrbücher, and Westermann's Monatshefte. They are thoroughly representative, if not the very best literary journals.

The main purpose of this dissertation is to give, by ample quotation and descriptive analysis, a detailed presentation of the various critical writings scattered over the journals in question. The journals were not sampled but every article relevant to the topic was excerpted for purposes of this investigation. The final endeavor was to analyse the critical tendencies that appeared predominant in these articles.

The distribution of the material and the structure of the dissertation was based on the content of the articles and resulted in this tripartite division: (1) criticism of the literature of the past, (2) criticism of foreign literatures, (3) criticism of contemporary German literature. In Part I, there was surprisingly little on the literatures of Antiquity; on the other hand, the definite standards arrived at in the evaluation of the German classical period left nothing to be desired. In Part II, the very scope and thoroughness of German interest in foreign literatures was so striking as to constitute almost the chief feature of this dissertation. In Part III, an unexpected waning of interest in what had been the main German achievements -- the drama and the lyric -- was to be recorded, and the novel clearly overshadowed all other literature. It was felt that the equal distribution of attention given to (1) the past, (2) foreign literature, and (3) the literature of the moment was in itself a remarkable fact.

In the course of the investigation it was found that despite the reputation of the years immediately following the Franco-Prussian War, the decade of the 1870's was not literarily sterile. The literary criticism reflected in representative periodical literature reveals a surprising variety, much scholarly workmanship, and high standards. An impressive array of literary historians and critics, from many fields of intellectual activity besides professional criticism, made up the list of contributors to these journals. Contrary to general belief, the creative and critical activity of this decade paralleled political and economic progress; and this intellectual climate was not least stimulated by the systematic work of literary criticism in the German periodicals of the eighteen-seventies.

Microfilm $3.90; Xerox $13.20. 302 pages.

ANTOINE LE METEL, SIEUR D'OUVILLE: HIS LIFE AND HIS THEATRE

(L. C. Card No. Mic 58-7911)

James Wilson Coke, Ph.D.
Indiana University, 1958

D'Ouville, brother of Bois-Robert, was a man of varied experience and considerable learning. He was a serious student of Spanish, and once lived seven years at the Court in Madrid. Professionally, he was a geographer, hydrographer, and ingénieur; about 1621, he became an employee in the government of Louis XIII, subsequently being made "ingénieur et géographe du Roy." Although there apparently remain no documents attesting the place or date of d'Ouville's birth, the present study shows that he was born in Rouen, rather than in Caen, as has heretofore been believed, and that he was born prior to 1589, perhaps in 1587, instead of in 1590, the generally accepted date. He made his literary debut in 1637, with Les Trahizons d'Arbiran. By 1646, he had published eight other plays and a collection of contes, interrupting his literary career to accept employment by Louis Foucault, Comte du Dognon, who, during the years of the Fronde, became a notorious public figure. Before terminating his seven years of service with Dognon, d'Ouville, in 1650, published his last play, Les Soupçons sur les apparences. He spent his final years in penniless retirement at Le Mans, where he died in 1655, translating Spanish prose works into French.

Of d'Ouville's ten plays, seven are adaptations of Italian and Spanish models. He unwisely sought inspiration for his Morts vivants (1646) and Aymer sans sçavoir qui (1646) in an outmoded sixteenth-century theatre. D'Ouville's plays, like his models, d'Oddi's Morti vivi and Piccolomini's Hortensio, are intricate exercises in reality and illusion. Both plays are essentially sterile: the action is minimal, the characters are without human dimension, as it is not within the scope of this theatre to probe into the problems of human existence. D'Ouville initiated the Spanish vogue in French comedy, which reached its height in the 1640's. Calderón's Dama duende, Casa con dos puertas, and Astrólogo fingido were d'Ouville's sources, respectively, for L'Esprit folet (1642), Les Fausses Véritez (1643), and Jodelet astrologue (1646), all of which were successful in Paris; Lope's Ausente en el lugar was the basis for his most unsuccessful attempt at comedy, L'Absent chez soy (1643); and Montalván's Doncella de labor inspired his delightful Dame suivante (1644). Although he did not lift his models from the realm of fact and intrigue nor permit his characters the experience of contemplation and self-analysis, although he did not attempt to provoke thought or to move the spectator, he did abridge, unify, energize, and gallicize the essentially spirited but intricate and prolix comedias, with the result that his revisions, technically, at least, are indicative of his theatre sense and his quality as a dramatist.

D'Ouville's original compositions are very creditable plays. The clever, sophisticated, and mundane Coifeuse à la mode (1646), a comedy in the Spanish vein, is in part a comedy of manners. His tragicomedies, Les Trahizons d'Arbiran (1638) and Les Soupçons sur les apparences (1650), which deal with moral problems and whose characters, particularly the Iago-like protagonists, have not been dehumanized in lieu of an all-absorbing intrigue, are his most forceful plays.

The vision of d'Ouville the dramatist is a baroque one. Baroque art is concerned with the dynamic, the theatrical, the elusive, the eternal becoming. It thrives on contrast and complexity, on shifting semblances and illusion. In spite of the various illusions and vicissitudes, the episodes of the intricate plots, in most of his plays, collaborate to form a complex action, the major motif of which is the eventual destroying of the illusions created and the restoration of order; and in those plays where the intricacy of the interrelationships of illusion and reality do not encompass the whole of the action, they are still present and serve to motivate and energize it.

Microfilm $3.90; Xerox $13.20. 301 pages.

OCEAN'S POEM: A STUDY OF MARINE SYMBOLISM IN LEAVES OF GRASS

(L. C. Card No. Mic 58-1964)

Robert F. Gibbons, Ph.D.
Tulane University, 1957

Chairman: R. H. Fogle

Walt Whitman's testimony about the influence of the sea upon his poetry has been verified by students of his life and works. But no full-length treatment has been given marine symbolism in Leaves of Grass. An excellent point of departure for such a study is "In Cabin'd Ships at Sea," in which Leaves of Grass is called "ocean's poem." The listing of "In Cabin'd Ships" with two other "Inscriptions" -- "To Thee Old Cause" and "Poets to Come" -- suggests that Whitman regarded the three poems as keys to his aims and methods.

"In Cabin'd Ships" points to Whitman's dialectical method in general and specifically to an opposition involving on one hand the land and grass and on the other hand the sea and fluidity. In addition, the poem presents a catalogue of the symbolic values of ocean exploited in Leaves of Grass.

The grass-fluidity tension is evident in Whitman's search for titles and themes. Some of his notebook studies show a deliberate attempt to fuse the ideas of wateriness and vegetation. Leaves of Grass as a whole is a synthesis of the two forces.

Whitman set out to write a poetical "New Bible" that would be in accord with "the last results of modern science." In his myth of creation he used the grass as a symbol of the life-force, the ocean and fluidity as symbols of the impalpable source of individual forms, as symbols of a base underlying the dynamic processes of the visible universe. The fluid base pervades at the same time that it sustains the visible forms of creation. It is reflected in the fluidity of music, of words. It tallies ultimately with both the Hebraic myth of creation and prevailing scientific theory.

Whitman saw much of the world of his poetry in terms of things marine. It was, first of all, a fundamentally fluid universe. But beyond that was an illusion of a world divided between the relatively solid and the relatively liquid. Within that illusion the waters of the world were to be catalogued, along with the men who sailed them. Then, beyond catalogues there was a wealth of imagery. The sea was of

many phases, and the world could be spoken of metaphorically in terms of those phases. The idea of the ship could be projected until the globe could be seen as a ship, or even the cosmos. Heroic individuals could be imaged as mariners, for mariners were heroic.

The tidal rhythm of the sea symbolized a basic principle of withdrawal and return. Man came from woman and returned there. Man came from God and returned there. The return to God and Immortality was by way of the joyous voyage of death. At the end of the voyage the soul returned into the sea of God from which it had come. It was immersed, dissolved, became a part of total unity.

The ocean and the grass are Whitman's two chief concrete symbols. His use of them helps justify his claim that his book is a unified work and supports a growing feeling among Whitman students that he stands among the world's great poets.

Microfilm $4.30; Xerox $10.40. 233 pages.

SCOTT FITZGERALD: ROMANTIC AND REALIST

(L. C. Card No. Mic 59-747)

John Richard Kuehl, Ph.D.
Columbia University, 1958

Scott Fitzgerald: Romantic and Realist is based upon a study of all available Fitzgerald material, published and unpublished. In the first category I have used the entire canon of the author's works, consisting of five novels (four finished and one left incomplete), approximately one hundred and sixty short stories, miscellaneous fiction, articles published in magazines and newspapers, poetry, and one play, The Vegetable. In addition I have had access to much unpublished material. From Fitzgerald's daughter, Frances Scott Fitzgerald Lanahan, and from his agent, Harold Ober, I received permission to use and quote from the Fitzgerald collection deposited in the Princeton University Library. This consists of a library (the catalogue here published for the first time) of approximately one thousand volumes, many of them inscribed by the authors, some with Fitzgerald's comments. The collection also includes Fitzgerald's correspondence, the Notebooks, typescripts, manuscripts, galley proofs, corrected first editions, notes and outlines for stories and novels. The correspondence is voluminous, including Fitzgerald's own letters and letters to Fitzgerald from important men and women of his time. Much of the material from which I have quoted has never before been used.

Throughout the novels and short stories of Scott Fitzgerald, two dominant themes persistently recur. On the one hand, Fitzgerald was a realist, following in the traditions, well established in his time, of the novel of social realism and the novel of manners. On the other hand, he was, both by nature and persuasion, a romantic. In his best work he blends a realistic treatment of American culture of the twentieth-century with a sense of the abstract, the ideal, even of the mythic. This fusion of the novel of manners with the novel of romance explains the lasting power of his best work.

The Prologue deals briefly with those aspects of the author's biography which seem to me essential for an understanding of his novels and short stories. Some of this is based upon unpublished material.

In Chapter I (with Appendices A and B) I have attempted the first comprehensive examination of Fitzgerald's reading in an effort to determine the authors, both older and contemporary, who were most responsible for his romanticism and realism.

In Chapter II, again making use of many unpublished documents and other unused material, I have investigated his critical opinions in order to establish his attitudes on such subjects as craftsmanship, morality, and subjectivity-objectivity.

In Chapter III I have studied the two themes of romanticism and realism as they appear in short stories and the two earlier novels, This Side of Paradise and The Beautiful and Damned. Many of my conclusions are based upon articles, some of them not previously noted by critics, upon letters published and unpublished, and upon the Notebooks.

In Chapter IV I have treated the artistic fulfillment of the two dominant themes in the three major novels, The Great Gatsby, Tender is the Night, and The Last Tycoon. These works have purposely been discussed separately because, while they contain thematically little that had not been expressed in the other works, they represent the author's most intense and profound use of his two major motifs. Microfilm $3.00; Xerox $10.40. 231 pages.

SAINT-EXUPERY'S CONCEPT OF IMAGE AND SYMBOL AND ITS APPLICATION IN COURRIER-SUD

(L. C. Card No. Mic 59-405)

Marion Bonner Mitchell, Ph.D.
The Ohio State University, 1958

All of Saint-Exupéry's works, including the posthumously published Carnets and correspondence, show evidence of his life-long preoccupation with the nature of human knowledge and expression. He arrived at a relativistic, yet dynamic conception of truth in which apparent contradictions often stand as equally authentic -- if incomplete -- descriptions of reality. The resolution of contradictions through creative thought and feeling permits progress toward an eventual mystical concept which will "unify the world." Saint-Exupéry believed that creative thought is effected mainly in terms of images and symbols and that it has as its basis the intuitive or poetic perception of valid analogies which escape the process of logical reflection. The principal images and symbols according to which an individual is accustomed to think constitute a sort of personal inner "universe," or a "language" by means of which he interprets the world. Saint-Exupéry's opinions concerning actual linguistic expression tie in closely with his conceptions of truth and knowledge. Though he remarks incessantly that words deform thought, he has great confidence in the efficacy of symbolic and imaginative language, which, when subjected to critical control, may catch truth as in a "trap" and transmit it from one mind to another.

These theories are faithfully reflected in the literary practice of his first book. Far from representing simply an early and awkward attempt by the author to express his philosophical ideas, Courrier-Sud, 1928, is an artistically conceived and executed novel whose chief merit is in the presentation of character and of psychological movement.

The action is narrated (generally in the form of recollections) by a friend of the main characters, Bernis and Geneviève. These two, having been children together, have a brief love affair as adults and then die, Bernis while flying the mail toward Dakar, and Geneviève in her ancestral home. They belong to opposing, contradictory physical and spiritual worlds, Geneviève to one of tradition and domesticity and Bernis to one of physical adventure and intellectual inquiétude. Each thinks often in terms of favorite symbols or interprets external phenomena symbolically according to personal moods and beliefs. Thus Geneviève conceives of her way of life as a "navire" which provides security and "sens," and she is reassured by the sight of her bibelots arranged in a showcase because they symbolize order, durability, and "superficial clarity." Bernis distrusts the qualities of Geneviève's world and thinks of his own life as a mysterious quest for "le trésor," "l'envers des choses," etc. Laying bare the very imaginative and symbolic substance in the minds of Geneviève and Bernis, Saint-Exupéry achieves a remarkable depiction not just of character but also of the psychological movements which determine the main plot. Thus images such as the "navire" are veritable protagonists or participants in the novelistic action.

The images of Courrier-Sud are not isolated or independent but are related among themselves in source and literal meaning and also in symbolic significance. They group readily into themes based upon obsessive preoccupations of the characters. In a number of passages particularly dense with symbolic meaning the author brings together the principal themes and imaginative leitmotiv. It is in these passages that his careful thematic anticipation and preparation of imaginative conceptions is most evident, and also here that he juxtaposes most effectively certain imaginatively expressed contradictions in the minds of the characters.

Though the author has created in Courrier-Sud primarily a psychological novel, the book contains in a subordinate role many of the personal philosophical conceptions which were to constitute the main substance of later works. These conceptions are already embodied in imaginative expressions which herald the great symbols of Saint-Exupéry's future humanism.

Microfilm $3.65; Xerox $12.40. 281 pages.

LAKE POET AND LAUREATE: SOUTHEY'S SIGNIFICANCE TO HIS OWN GENERATION

(L. C. Card No. Mic 58-7926)

Warren Upton Ober, Ph.D.
Indiana University, 1958

This dissertation attempts to determine the impact of Robert Southey the poet upon his own generation. The study (aside from the prefatory chapters on Southey's life and his theory of poetry) falls naturally into three divisions: the reaction of the critics and the public; the judgments of the six great Romantics who, as Southey's friends and correspondents, knew him best; and the influence of the poet upon his contemporary Romantics.

Though Southey never became popular, in the sense that Walter Scott was popular, he was recognized, after the appearance of his Joan of Arc in 1796, as a power to be reckoned with in poetry. The Anti-Jacobin soon named him as the typical Jacobin poet, and Jacobin he remained until Francis Jeffrey in 1802 perceived in him one of the "chief champions and apostles" of a new school of poetry: the Lake School. Southey as Jacobin and Lake Poet was widely regarded as a poet of genius who perversely squandered his rich gifts in the composition of poetry that lay outside the pale of all accepted standards.

The initial decline of Southey's reputation, a decline from which it has never recovered, occurred after his affiliation with the Quarterly Review in 1809 and, especially, after his acceptance of the Laureateship in 1813. This decline resulted from the efforts of vociferous critics who attacked Southey on personal and political, not literary, grounds. Thus a mention of his name today evokes the image of Hazlitt's shameless renegade or Byron's dunce-like Laureate.

Yet, among the six great Romantics who knew him best there was not one who condemned him both as a man and as a poet. No shallow turncoat, no facile poetaster could have aroused the widely varying reactions of Coleridge, Lamb, Wordsworth, Scott, Landor, and Shelley. Themselves literary masters, Shelley, Scott, Lamb, and Landor regarded Southey as a poet of genius. Of the group only Wordsworth consistently and Coleridge occasionally expressed contempt for Southey's poetry. Landor, Lamb, Scott, and Wordsworth regarded Southey the man with admiration and affection, though Shelley despised him. Coleridge's comments on his friend's character and poetry ran the gamut from diatribe to rhapsody.

Finally, Southey left his impress on the work of his contemporaries. He encouraged such major figures as Lamb and Landor and such minor ones as Elliott, White, and Bowles in the composition and publication of their works, and he seems to have been almost a collaborator in Charles Lloyd's novel Edmund Oliver, which contains a most unflattering portrait of Coleridge. Further, Southey exercised a great influence over the poetry of Shelley. And perhaps the most significant aspect of this study is its evidence that Southey's influence might well have been an important factor in the conception and shaping of Coleridge's "Rime of the Ancient Mariner," "Christabel," and, especially, "Kubla Khan." Certainly the evidence that these poems owe a debt to Southey's poetry, notes, and reading is sufficient to justify a thorough re-examination of the Coleridge-Southey association.

Microfilm $5.15; Xerox $18.40. 401 pages.

THE RECEPTION OF AMERICAN DRAMA IN AMERICA AND IN ENGLAND, 1900-1915: A COMPARATIVE STUDY WITH EMPHASIS ON THE REACTIONS OF ENGLISH CRITICS

(L. C. Card No. Mic 58-7930)

Herbert Jackson Risley, Ph.D.
Indiana University, 1958

The present study attempts largely to determine how American drama was received by English critics in the years from 1900 through 1915. English and American reviews are compared so that whatever reactions were

essentially English may be identified. The opinions of the critics are also measured against the public response.

The period emphasized in the study was an important era in the development of the American theatre. Experiments in aesthetic drama, the establishment of repertory theatres and other organizations for promoting plays of high quality, the popularity of college courses in dramatic literature and playwriting, and an increasing tendency to publish plays were signs of a growing public interest in drama as an art. Cosmopolitan tastes were reflected in the offerings of the commercial theatre. At the same time a fairly large number of American plays, with the help of enterprising managers like Charles Frohman, were presented in England.

The American playwright who was probably best known in England shortly after the turn of the century was Clyde Fitch. Although his own countrymen frequently objected that his work was superficial, the perennial appearance of his plays on American stages, his reputation for launching actresses on promising careers, and a widespread recognition of his wit and ingenuity made him a significant figure at home. The English, who saw a representative selection of his plays, were less convinced of his importance; yet they, too, were sometimes impressed with his insight into character and the power or delight with which he invested some scenes. Four of his plays, including his famous comedy The Truth, were very popular in London.

A number of Americans who attempted to create plays with significant themes and poetic values gained acceptance more readily in their own country than in England; yet they enjoyed some moments of honor abroad. With The Piper, a drama in verse, Josephine Preston Peabody attained special renown as the winner of an important playwriting contest connected with the annual Shakespeare festival at Stratford-on-Avon. Having been acclaimed there and elsewhere in England, The Piper ran only a short while in London, where critics regarded it as a charming and colorful piece, though some of them found it excessively rhetorical. The London reviewers also considered Percy MacKaye's Jeanne d'Arc, another verse drama, worthy of the stage, though mechanically a little absurd and less truly poetic than MacKaye had intended. Among other plays with which MacKaye had aroused the interest of his fellow Americans, The Scarecrow, a significant novelty in prose, had in England only a brief, though commended, showing in Bristol, and Mater, a comedy, displeased the London critics. Like MacKaye, William Vaughn Moody had much less stature in England than in America. The Great Divide, Moody's dramatization of the Puritan-pagan conflict in the American soul, was widely discussed and often eulogized in America; in London, where the play remained only a few weeks, its boldly melodramatic first act was its chief attraction, and its psychological probing was thought confusing and annoying.

In general, the notices of the plays already mentioned and of other American plays of the period reveal that, although the English frequently found American drama crude, imitative, artificial, or excessively didactic, they were not categorically hostile to it but tried to evaluate it objectively. They readily acknowledged American talents for creating bold and fresh effects, fascinating characters, and well-organized action. The English particularly admired American melodrama: they often enjoyed plays about criminals, well-wrought plays set in the West, and elaborately staged romances of the Orient. Comedies, including farces, had nearly equal chances of pleasing and displeasing the critics; they tended to favor unsophisticated comedies about eccentric characters. Altogether, a respectable number of American plays scored London successes, for which the actors, of course, were frequently given much credit.

Microfilm $4.90; Xerox $16.40. 381 pages.

SHAW'S WOMEN CHARACTERS: AN ANALYSIS AND A SURVEY OF INFLUENCES FROM LIFE

(L. C. Card No. Mic 58-7931)

Jean Louise Shields, Ph.D.
Indiana University, 1958

Shaw's intimate knowledge of a large number and variety of women influenced his works. Direct influences are found in his creation of women characters which he knew could be interpreted by particular actresses and in his dramatizations of scenes from life. The indirect influences are more important and far reaching. The most influential woman in his life was his mother: he admired her from childhood for her ability but he suffered from her coldness and lack of domesticity. Her indifference to sex along with the peculiar chasteness of the Irish environment and temperament made him always disapprove of sex even while, influenced by Jenny Patterson and the other women he came to know, he made the sex drive the most essential element to the progress of the Life Force, distilled sexual attraction and presented it on the stage in the relationship between Ann Whitefield and John Tanner. In Ellen Terry he knew a charming woman with a wise heart; in Mrs. Patrick Campbell a temperamental and cruel fascinator; in Annie Besant a spirited, emotional reformer; in Beatrice Webb an aristocrat and scholar; in Florence Farr an intellectual, unconventional actress. From them all he learned that loving and being loved was much more important to women than his mother's example had made him believe. At twenty-nine he began a primarily physical affair with Jenny Patterson; he loved Florence Farr intensely but briefly; Janet Achurch (according to Tullah Innes Hanley) over a period of years; and Mrs. Patrick Campbell fleetingly. He married Charlotte Payne-Townshend; but he was never able to love any woman completely. He liked and respected Charlotte Shaw but he did not pretend to be emotionally involved with her: at the time of his marriage he was ill and indifferent about his life. In marrying him she deliberately undertook the role of guardian to a genius. Their marriage may never have been consummated. Dreamer and dedicated reformer, artist and intellectual, he was spectator not participator in the experiences and emotions of ordinary individuals; he did not have that mad little bit of self in him which would have enabled him to love a real person. He sought a goddess of superior beauty, intelligence, and morality. He never found her, but he created her in his most admirable women. In making them equal to men and accepted as equal, direct and honest yet fascinating, feminine, and loved, he set a standard not yet achieved; he pointed ahead--of our time as well as of his. Shaw did a great deal of thinking and writing about women. He believed in women's ability and sympathised with the demands of the suffragets, who were making women a subject of much interest and a political question in his day.

However, he had no liking for the "new" women who tried to look and act like men, who felt they must submerge their femininity in order to be free. His most capable and admirable women assert their femininity and a large part of their success is the result of their doing so. Shaw did not much believe in the practicability of marriage; he deplored especially the marriage laws of his time, suggested many changes, some of which have come into effect. He insisted that women must be politically, socially, and economically equal to men. But he would have been interested in women even if there had been no woman question. With the sensitivity of the artist he felt a certain kinship with women, possessed almost a woman's point of view. In addition to what he learned about women from experience he had an instinctive knowledge of them. This he proved in his depiction of the women in the novels, which were written while he still possessed very little first hand knowledge; and this he has demonstrated particularly well in his treatment of unsuccessful and unattractive women, and the conventional "womanly" women, whom he did not like. This understanding enabled him to depict many kinds of women and to do so with much psychological insight, to show the intricacies of human relationships, with acuteness and subtlety. Always controlled by reason and not by emotion, he made no full-length study of passion even though he understood it and demonstrated his understanding in fragments of scenes and even in stage directions. He created a majority of beautiful, independent, intelligent, capable women; they are the women one thinks of in connection with Shaw, and the women he would wish to be associated with him: they are the women of future decades. But it is not desirable to divide his women into groups: they are so well individualized and there is so much variety in them that they will not be pigeonholed. Shaw's women characters represent all womankind. Microfilm $4.50; Xerox $15.00. 350 pages.

ROMANTIC HELLENISM IN ENGLAND: A FACET OF THE ROMANTIC REVALUATION OF THE PAST

(L. C. Card No. Mic 59-452)

Cayle Stanley Smith, Ph.D.
Cornell University, 1958

Chairman: Professor Stephen M. Parrish

Renewed interest in ancient Greek thought and life was one of the many Romantic "revivals," but the Greek Revival is more significant than, say, the Gothic Revival, for three reasons. First, its popular impact was, if anything, greater, and yet was based on a more scholarly foundation. Second, it offers a more meaningful contrast with preceding English tradition. And third, it had deeper and more lasting effects.

The scope of popular enthusiasm for Greek antiquity during the Romantic period is, at first glance, the most striking quality of Romantic Hellenism. The "Grecian Fad" affected more Englishmen in more ways than the neoclassical interest in antiquity had. Greek poets and Greek historians had received substantial deference from neoclassic gentleman, but certainly no more than From Romantics; and Romantic enthusiasm for ancient Greece went well beyond literature. The "Grecian style," which invaded architecture, dress design, and the fine arts in the years around 1800 bespeaks a breadth of influence surpassing anything observable in the previous age.

This Greek enthusiasm was ambiguously related to eighteenth-century classicism. On the one hand, it was a natural outgrowth of a steadily increasing dilettante interest in things Greek--the ruins of Greek architecture and antique objects of art. On the other hand, it was an expression of dissatisfaction with the conservative, Latinate, and gentlemanly classicism which (Romantics readily assumed) had bound and hampered free thought and free behavior in the days of Pope and Chesterfield. Thus, while historically the Greek Revival was a culmination of tendencies present in the eighteenth century, intellectually it was a symbol of revolt against neoclassicism. This element of revolt is vividly illustrated by the Orientalizing strain which began noticeably to affect Hellenism a few years before 1800. With Sir William Jones, the view that oriental "wildness" was as much a part of the ancient world as was classical "serenity" found a foothold in the English imagination. In a very few years Romantic writers were able to make a virtue of "Dionysian" elements in Greek antiquity--elements which had earlier been dismissed as not truly classical. A nominal distinction between the classical and the oriental remained, but the lines of demarcation had become vague, as both concepts became supplementary elements in the larger vision of Philology--the study of antiquity as a whole.

At the same time, a new emphasis on the life, as distinct from the conscious literary art, of the Greeks, was further undermining the edifice of neoclassicism. Archaeology, deriving initially from dilettante interest in Greek ruins, afforded material for the re-creation of ancient life in contemporary detail. A re-examination of the tests, with new eyes, supplied more material. The development of Homeric criticism illustrates this change of perspective: at first, interest in Homer's times threw doubt upon the aesthetic concept of a conscious master-artist; eventually (by the mid-nineteenth century) interest in Homeric culture threatened to supplant aesthetic interest in the poems altogether.

The resultant of the several tendencies here summarized was a view of ancient times at once more accurate and more strange than that of the neoclassic gentleman. With the acceptance of oriental elements into Hellenism, and with an increased awareness of the uniqueness of different milieus of antiquity, the force of Hellenism diminished. Detailed comprehension of cultural differences, especially, led to a sense of the futility of imitating the outward Greek forms, and to a lessening of prestige for the classics as universally applicable expressions of a constant human spirit. Ultimately, emphasis upon organic individuality in the study of the past was to weaken the hold of the classics, or at least to narrow the range of their appeal from popular to professional.

Microfilm $3.00; Xerox $10.40. 231 pages.

TRISTAN CORBIERE AND THE MORAL STRUCTURE OF LES AMOURS JAUNES (VOLUMES I AND II)

(L. C. Card No. Mic 58-7890)

Albert Sonnenfeld, Ph.D.
Princeton University, 1958

The purpose of this dissertation is to study the life and works of Tristan Corbière with particular emphasis on the symbolic role played by Paris and Brittany in the structure of Les Amours Jaunes and on Corbière's stylistic

idiosyncrasies and complex poetic innovations. A biography based largely on an analysis of hitherto unpublished letters and poems opens the work. Here it is shown that the adolescent poet-to-be already had the psychological traits of the Corbière of Les Amours Jaunes. He sought to imitate his father's literary and nautical exploits; he had an abnormal need for affection that, in vain, he tried to hide by posing as an ironic and superior adult. But Tristan failed in his every endeavor. His love for the Parisian actress whom he named "Marcelle" was rejected because she considered him too ugly and eccentric; he could not fulfill his ambitions to become a sailor because, at an early age, he was severely crippled by rheumatism. Ultimately, Corbière felt that destiny had betrayed him; hence, the yellow of Judas in the title Les Amours Jaunes. Corbière's poems constitute a spiritual autobiography. A careful analysis of the main themes and use of setting shows that Corbière condemns Paris for its artificial standards of excellence which made Marcelle refuse her love to the ugly provincial. In contrast, Brittany is the land where the ugly are worshipped in the Pardons. Brittany is also "Armor," the land of the sea, where, through poetry, Corbière can create an imaginary new existence as a sailor. The structure of Les Amours Jaunes, the first three chapters treating the Paris theme, the last three the Breton, reflects the poet's desire to return to his native province and to recapture his childhood. An appraisal of his relationship to Lamartine, Hugo, Musset, the Parnassians and Baudelaire shows that he knew the works of these major poets well, but used them primarily as material for parody. Only his father's sea stories are treated respectfully. Corbière's role as poetic innovator is then discussed in detail. He often gives way to a Rabelaisian verbal intoxication where poetry is deformed into a series of puns which introduce a new kind of humor in verse. At times, his imagery seems to be dictated by the suggestive power of a sound or rhyme, a technique foreshadowing the automatic writing of the Surrealists. In conclusion, Corbière's role as precursor is assessed. He is shown to have greatly influenced the poetry of Laforgue, Eliot, Pound, Salmon and Carco. The appendices contain the manuscripts of three unpublished poems, eight unpublished letters and several hitherto unknown drawings, as well as photographs of Corbière's notations on his own copy of Les Amours Jaunes.

Microfilm $6.00; Xerox $21.00. 469 pages.

GOTTFRIED KELLER'S LITERARY THEORY AND PORTRAYAL OF MEN

(L. C. Card No. Mic 58-7670)

Lawrence Moore Washington, Ph.D.
Brown University, 1958

This investigation undertakes to present a comprehensive study of the men characters in the prose works of Gottfried Keller. Lack of previous systematic inquiry into this feature of Keller's production is paralleled by an almost complete absence of studies dealing with men characters of other German authors.

In treating Keller's men, a basis for classification has been derived from an inspection of Keller's literary theory and view of man, which is to be found mainly in his correspondence. The presentation thus falls into two parts: the first deals with Keller's artistic theory and practice, and the second discusses the men characters from the standpoint of the principles developed.

As a realist, Keller believed that a writer should deal primarily with contemporary social and cultural phenomena, and should in so doing maintain an attitude both of moral concern and intellectual objectivity. Keller also continued the tradition of the epic artist and the concept of classical Humanität in German literature in concentrating his efforts on the depiction of individual human development as it is related to the whole of society. This view of man in Keller's thought was crystallized under the impact of Ludwig Feuerbach's philosophy.

In the ideal situation, man is a self-determinative human being whose activity not only expresses personal desires and capacities but also contributes to the welfare of a larger group. Thus, Keller's men characters are divided into adaptable (dynamic) and rigid (static) types, according to their ability to overcome egocentric fixation which inhibits perception of themselves and of the outer world.

Some of the judgments passed by Keller on his contemporaries are extant and accessible in his letters; the qualities which he admired or condemned in living persons are reflected in his fictional characters. In his fictional portrayals he does not generally give direct psychological descriptions but prefers to reveal inner qualities through the appearance, setting, and action of his characters.

Keller's predisposition to portray his ideal of human development positively can be observed in the large number of major men characters who exemplify the change from a condition of deluded subjectivity to self-knowledge and effective contextual integration. This developmental pattern is discernible throughout his prose production. In the novel Der grüne Heinrich the insight of Heinrich Lee into his true nature, which is attained in the original version of 1854-55, is shown to lead him to effective activity in the revised version of 1879-80. Heinrich changes from a self-centered dreamer with a fanciful picture of himself as a painter and a student of nature to a useful citizen who finds his role in life as a public official.

A similar break-through to reality is observed in the central male figures of Pankraz der Schmoller, Frau Regel Amrain und ihr Jüngster, each story in the second volume of Die Leute von Seldwyla, Hadlaub, Der Landvogt von Greifensee, Eugenia, Die Jungfrau als Ritter, and Der schlimm-heilige Vitalis.

Some men characters already possess the desirable balance; these frequently are older men, e.g. the Graf in Der grüne Heinrich.

Development in the static characters is inhibited by factors which blind them to their faults and true capacities and prevent their forming productive relationships. Passively submissive men and those who renounce life fail to fulfill Keller's requirement that the individual develop his potentialities while conceited, pretentious, and ambitious men do not attain rapport with the outer world because their interest is concentrated on self-gratification.

Keller's characterization of men is fundamentally expressive of his moral and social views and confirms his significance as an outstanding realist in the German literature of the nineteenth century.

Microfilm $2.70; Xerox $9.40. 206 pages.

BIOGRAPHY IN AMERICAN LITERATURE, 1800-1860

(L. C. Card No. Mic 58-5976)

James Wilson Webb, Ph.D.
The University of North Carolina, 1958

Supervisor: Raymond Adams

This study aims to supply a need for investigation of biographical writing in the hands of literary minded biographers and historians in America from 1800 to 1860.

Only two scholars have published treatments of sizeable length on the subject of biography in America. In 1932, Professor Dana K. Merrill published a 105-page work, The Development of American Biography, which begins the study of biography in the early English Colonial period and closes with the year 1930. The author treated the subject of biography somewhat generally. In his preface he wrote that his introductory examination of the field aimed to present a chronological outline of the subject and to indicate its importance as an art form. The other scholar, Professor Edward H. O'Neill, published A History of American Biography, 1800-1935, in 1935. This work which contains four hundred and twenty-eight pages, devoted a chapter of twenty-six pages to the period 1800-1860. In 1939, Professor O'Neill's Biography of Americans, 1658-1936: A Subject Bibliography was published. This bibliography is invaluable for investigators in the field of American biography.

For background material I read the works of scholars on the subject of biographical writing. I read all the biographical writings of Mason Locke Weems, Jared Sparks, William Gilmore Simms, and Washington Irving - figures who were considered to be representative of the period, 1800-1860, and who were given particular attention in this study. In addition to the writings of these men, I read all significant biographies of the period. In order to discover aims and criteria, I took particular notice of the content of the prefaces in biographies and reviews in contemporary magazines such as The Analectic Magazine, The North American Review, and The Southern Quarterly Review.

My plan of procedure in going about this work was: first, to investigate and consider the development of biography as a literary genre; second, to make a survey of biographical writing in America between 1800 and 1860; with emphasis on significant biographies; third, to make a somewhat detailed study of the four representative biographers - Weems, Sparks, Simms, and Irving; and fourth to conclude with a summary of observations made and conclusions reached as the result of my investigations. Emphasis has been placed on such matters as the development of biography as a literary genre, the methods and devices employed, the aims, and critical theories developed and put into practice. Biographers and their works were treated chronologically in order to observe the trend of development in biographical writing from the time it was written with little or no conscious attention to form to the time it was taken over by talented and literary minded writers.

Results of this investigation clearly indicate that biographical writing in America during the first half of the nineteenth century progressed from being a didactic and eulogistic work written in anecdotal fashion to one exhibiting literary qualities and unified narrative skill. Because of an energetic search for original materials, accurate recording of facts for the purpose of teaching history, and the attention to matters of organization and literary style to make the work more entertaining to read, writers of the period were able to make biography a literary form that competed with the novel and other literary forms for readers. In their hands, biographical writing reached a pronounced level of intellectual maturity as literary art. Microfilm $5.00; Xerox $16.80. 389 pages.

MARIAN EVANS TO GEORGE ELIOT: THE MORAL AND INTELLECTUAL FOUNDATIONS OF HER CAREER

(L. C. Card No. Mic 58-7899)

Michael Wolff, Ph.D.
Princeton University, 1958

George Eliot's popular success as a novelist and her profound acquaintance with important areas of nineteenth-century thought are two factors which, when seen in conjunction, demand careful scrutiny. The effect of her extraordinary mental development on her fiction cannot be properly determined until the constituents of that development are clearly identified. It is the purpose of the present study, by using evidence only recently available, to give a detailed account of George Eliot's moral and intellectual habits. The account of these habitual attitudes concurrently demonstrates their relevance to a greater understanding of her fiction.

The primary material of this study is the body of book reviews, written by Marian Evans between 1855 and 1857; but considerable attention has been paid to her other essays, and to her letters, poems, translations, and, of course, novels and stories. Chapter I, introductory in nature, discusses the value of using non-fictional writings for the study of so intellectual a novelist as George Eliot, identifies these writings, and reviews previous scholarship. Chapter II takes Marian Evans' life and thought from her rural childhood, through her Evangelicalism and her translating of Strauss' Das Leben Jesu, into the world of intellectual London journalism. This chapter goes on to describe Marian Evans' early book reviews, and discusses, in particular, her relation to Lewes, Comte, and Feuerbach.

The remaining chapters treat, in order, Marian Evans' views on philosophy, on ethic, on religion, on society, and on the function of the artist in society. Chapter III suggests in some detail the philosophical assumptions underlying Marian Evans' positivism, particularly her emphasis on the primacy of experience. Chapter IV shows why ethics is at the center of her concerns and also that her ethical theory is based on the idea of sympathy as shared experience. In Chapter V one consequence of her view of ethics is examined: namely, that if religion is to be preserved, orthodox Christianity must be replaced by a simple love and reverence for the good. Chapter VI shows how her ethical and religious views attain their broadest scope in her consideration of social questions. In Chapter VII, it is claimed that, for Marian Evans, a crucial task facing her generation is to make the various ranks of society capable of sympathizing with each other's experience; that the most urgent aspect of this task is to make lower-class life intelligible to those who hold the reins of government; and that the particular responsibility for this lies with the artist, who has special powers enabling him to extend the experience of his audience by his sympathetic re-creation of life.

Thus this study aims to conduct the reader from Marian Evans' most basic assumptions through the logic of her ideas and up to the threshold of her artistic career.

Microfilm $5.20; Xerox $18.60. 408 pages.

PERMUTATION SUPPORT FOR MULTIVARIATE TECHNIQUES

(L. C. Card No. Mic 58-7813)

Harvey James Arnold, Ph.D.
Princeton University, 1958

Many writers have been concerned with the problem of justifying the use of standard tests based on normal theory assumptions when in fact the underlying distribution is suspected of being non-normal. This research has been concerned mainly with tests based only on univariate situations. They have found that the standard t and F tests are remarkably insensitive to deviations from normality.

Here, the multivariate generalization of the t test is investigated. The first four permutation cumulants are determined for a statistic which is a simple function of the commonly used Hotelling's T^2. In the univariate situation T^2 simply becomes the square of t, and tests based on T^2 are identical with tests based on t. Complete details of the investigation are carried through for only two dimensions but similar methods should apply to more dimensions. The derived permutation cumulants are applied to data obtained from a sampling experiment. The samples are from bivariate normal and rectangular populations. The samples drawn from the normal population served as a verification of the theoretical computations and also provided a comparison for the empirical results based on the samples from the rectangular population. The actual empirical calculations consisted in obtaining all the permutations of the statistic used (a function of T^2) for each sample and obtaining frequency distributions of the number of permutations which give values for the statistic which are greater than those obtained from normal theory assumptions for a certain significance level. It is observed that there is mild disagreement between the nominal percentage point of the test based on the assumption that the underlying distribution is normal and the actual percentage point obtained by considering all permutations of each sample from the rectangular population.

A discussion of various ways of adjusting the test criterion is included when one suspects that the data does not come from a normal distribution. These methods are used on the samples from the rectangular distribution. One of these methods provides excellent agreement at the various significance levels investigated.

Suggestions towards directions for future investigations are given. Microfilm $2.00; Xerox $4.80. 95 pages.

POLYNOMIALS ASSOCIATED WITH SECOND ORDER RECURSION SEQUENCES OF INTEGERS

(L. C. Card No. Mic 59-44)

Charles Ward Barnes, Ph.D.
The University of North Carolina, 1958

Supervisor: Edward T. Browne

This thesis gives a definition and discussion of polynomials arising from second order recursion sequences. The polynomials associated with the sequence

$$h_{n+2} = h_{n+1} + h_n, \quad h_0 = h_1 = 1$$

are discussed at length. It is proved in the thesis that many of the properties of this sequence of integers are also true for the polynomials associated therewith. The results are established in the main by the use of matrices, determinants, and continued fractions.

A new representation of the numbers h_n as a finite product is given.

In particular, it is proved that a great number of theorems concerning the numbers h_n, which were established by past writers using diverse methods, are really consequences of the well known method of Laplace for expanding the determinant of a square matrix.

Microfilm $2.00; Xerox $3.80. 68 pages.

PREDICTION THEORY

(L. C. Card No. Mic 58-7842)

Harry Furstenberg, Ph.D.
Princeton University, 1958

Given a time series which represents the past history of a variable, one may attempt to deduce information regarding the future values of the variable. In our presentation, the information sought takes the form of probability statements concerning the future. Under certain circumstances these probabilistic statements may be determined from the past history of the variable and our main concern is to show that this will be the case for large classes of sequences. A close connection exists between the sequences that we shall study and stationary stochastic processes. Every sequence that is sufficiently regular to qualify for predictability determines a stationary stochastic process and in many cases the predictability of the sequence depends only upon the process it "represents." The less complex processes such as Markov or multiple Markov processes are found to give rise to sequences which will be termed simply predictable. It is perhaps surprising that sequences derived in a natural way from simply predictable sequences need no longer have this property. In particular, sequences corresponding to

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"lumped Markov processes" need not be simply predictable. We find however that there is a notion of predictability which is suitable for these and similar processes which we refer to as statistical predictability. The principal concept in studying the latter is that of generic sequence of a process. Such a sequence exhibits the same statistical behavior as the process and in many cases we can show that a property that is true for almost all sample sequences of a process is true for a generic sequence. These ideas enable us to derive generalizations of classical theorems on equidistribution.

Microfilm $4.00; Xerox $13.60. 312 pages.

PLANE STRAIN IN A NETWORK OF SLIGHTLY EXTENSIBLE CORDS

(L. C. Card No. Mic 58-7644)

Samuel Milton Genensky, Ph.D.
Brown University, 1958

We consider a plane sheet of fabric formed by two families of thin, perfectly flexible, extensible cords which, in the undeformed state, are straight, parallel and equally spaced. The fabric is assumed to be a plane continuum which, in the undeformed state, is homogeneous. The analysis is restricted to plane deformations and body forces are neglected. Kinematic relations resulting from the constraints imposed by the extensible cords are developed for the fabric and stress-strain relations, equations of equilibrium and expressions for the applied edge tractions are also obtained.

It is then assumed that the deformation is sufficiently small so that terms of the second degree in the displacement gradients can be neglected, and that the tension in each cord is proportional to the fractional extension. Employing these additional assumptions, expressions are derived for the components of displacement, the equations of equilibrium, the stress-deformation relations and the components of applied edge tractions. It then follows from the equations of equilibrium that the fractional extension - and hence the tension - is constant along a cord of the sheet, but may vary from cord to cord. Several displacement and mixed boundary value problems are then examined and the resulting displacements are determined throughout the fabric. Next, it is shown that if tractions alone are specified on the edges of a sheet of arbitrary contour, then the displacements may only be determined to within an arbitrary, infinitesimal, inextensible deformation.

This is followed by an analysis and discussion of the deformation produced in a rectangular sheet of fabric clamped along a pair of opposite edges, the cords of this fabric being symmetrically disposed with respect to the bounding edges, in the undeformed state.

Finally, a sheet of material is considered composed of slightly extensible cords. Initially, the cords are assumed to be inextensible and the net is subjected to a finite deformation; then, assuming the cords of the resulting deformed sheet are slightly extensible, the net is subjected to an infinitesimal deformation. Expressions for the components of displacement, equations of equilibrium, stress-deformation relations and expressions for applied edge tractions are then developed. Furthermore, it is assumed that the applied edge tractions are not altered by the perturbation of the fabric. As an application of this theory it is assumed that the tractions applied to the edges of a sheet of arbitrary contour are known and the resulting displacements and tensions throughout the net are determined.

Microfilm $2.00; Xerox $4.40. 81 pages.

ON EXTREME GAMES

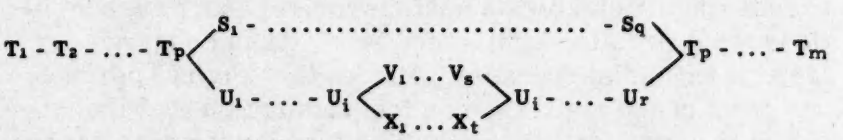
(L. C. Card No. Mic 58-7845)

James Hugo Griesmer, Ph.D.
Princeton University, 1958

In any fixed normalization, the set of n-person games can be represented by a convex polyhedron with the characteristic function of a game providing the coordinates of the corresponding point. A game is extreme if it can be represented by an extreme point of this polyhedron.

In terms of advantage to coalitions upon forming, the class of extreme games is closest to the class of inessential games. For, while the inessential are those in which there is no advantage in forming coalitions, the extreme games are those games in which we are assured that at least some--but not all--coalitions are likely to form. The property of extremeness insures the advantage in coalition formation is restricted.

Extreme games in both unnormalized and normalized forms are discussed. Two methods for testing the extremeness of games are given. I. Let v be a "partially normalized" game, i.e. $v(\{i\}) = 0$ for all $i \in I_n$, the whole player set. A flow assignment for v is a real-valued function I defined on the non-empty coalitions such that (i) $I(\{i\}) = 0$, (ii) $I(I_n) = 0$, (iii) $I(S) + I(T) = I(S \cup T)$ for all disjoint coalitions S, T such that $v(S) + v(T) = v(S \cup T)$. THEOREM: v is extreme $\Longleftrightarrow$ the only possible flow assignment is $I(S) = 0$. II. Let v be a (0, 1)-normalized game, i.e. $v(\{i\}) = 0$ for all $i \in I_n$, and $v(I_n) = 1$. A general chain for a coalition S is a network or chain of coalitions where



(i) $T_1 = S$, (ii) A_i is connected by an edge to A_{i+1} if either $A_i \cap A_{i+1} = \phi$ and $v(A_i) + v(A_{i+1}) = 1$, or $A_{i+1} = A_i - A_{i-k}$ and $v(A_{i+1}) = v(A_i) - v(A_{i-k})$, (iii) the network branches at B_i to both C_j and D_k if $C_j \cup D_k = B_i$ and $v(C_j) + v(D_k) = v(B_i)$. An indexing function for a general chain is a function I such that (i) $I(T_1) = +1$, (ii) $I(A_{i+1}) = -I(A_i)$ if $A_i \cap A_{i+1} = \phi$, $v(A_i) + v(A_{i+1}) = 1$, and $I(A_{i+1}) = I(A_i) - I(A_{i-k})$ if $A_{i+1} = A_i - A_{i-k}$, $v(A_{i+1}) = v(A_i) - v(A_{i-k})$, (iii) $I(C_j) + I(D_k) = I(B_i)$ if $C_j \cap D_k = B_i$, $v(C_j) + v(D_k) = v(B_i)$. THEOREM. v is extreme $\Longleftrightarrow$ every S, $v(S) \neq 0,1$, has a general chain which also ends in S, i.e. $T_m = S$, and $I(T_m) \neq +1$.

Partially normalized games which have three values are completely characterized for all n, through the use of these theorems, a graph associated with each game, and the matrix of detached coefficients for the system of inequalities defining the convex polyhedron. Besides the winning and losing coalitions present in simple games, or extreme games with two values, the class of intermediate

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coalitions, is present in these games. They make their presence felt in the solutions which are obtained. New types of discriminatory solutions are presented which give at least one solution for every game when n = 5,6. Finite solutions for symmetric extreme games with three values have been found for all n.

Although the sets of extreme games for the cases n = 3,4,5 have been completely characterized, the case n = 6 has only been partially settled; seven six-person extreme games, each with a different set of values, are presented. Discriminatory solutions for games in this class with four values are given.

Microfilm $2.00; Xerox $6.60. 140 pages.

SOME CONVERGENCE THEOREMS FOR CONTINUED FRACTIONS

(L. C. Card No. Mic 59-161)

Robert Heller, Jr., Ph.D.
The University of Texas, 1958

Supervisor: H. S. Wall

If each of a and b is a complex number sequence, then $\left(\frac{a}{b}\right)$ denotes the continued fraction

$$\cfrac{1}{b_1 + \cfrac{a_1}{b_2 + \cfrac{a_2}{b_3 + \ddots}}}.$$

If $\{f_p\}_{p=0}^{\infty}$ is the sequence of approximants of a continued fraction $\left(\frac{a}{b}\right)$, then the even part of $\left(\frac{a}{b}\right)$ is a continued fraction whose approximants are $f_0, f_2, f_4, \ldots$, and the odd part of $\left(\frac{a}{b}\right)$ is a continued fraction whose approximants are $f_1, f_3, f_5, \ldots$. The statement that the complex number sequence x converges absolutely means that the series $|x_1| + \Sigma_{p=1}^{\infty} |x_{p+1} - x_p|$ converges. R. E. Lane and H. S. Wall have given a necessary and sufficient condition for convergence of continued fractions whose even and odd parts converge absolutely.

This paper contains a theorem which states a necessary and sufficient condition for absolute convergence of the even and odd parts of a continued fraction. This theorem is then applied to demonstrate the convergence of some particular continued fractions.

Also, in this paper, a conjecture of Wall concerning a proposed extension of "the parabola theorem" of Scott and Wall is settled in the negative. Some additional conditions which are necessary in order for the conjecture to be true are found and a new convergence theorem related to this conjecture is proved.

Microfilm $2.00; Xerox $3.00. 30 pages.

ON SEMIGROUPS

(L. C. Card No. Mic 58-1966)

Naoki Kimura, Ph.D.
Tulane University, 1957

Chairman: G. B. Preston

Many theorems which hold for semigroups have obvious analogues for other algebraic systems. The first intention of this research was to find unified methods which would prove all such theorems simultaneously.

A semigroup is a multiplicative system subject to a single identity. In this thesis we consider a multiplicative system subject to a set ρ, say, of identities and call such a system a ρ-system. A multiplicative system is a ρ-system if and only if it satisfies the identities ρ: it may of course also satisfy other identities or properties. Thus a group is a semigroup. First we investigate some of the general properties of congruences on and subsystems of ρ-systems. We make use of a formal duality between some of the concepts used. Pairs of dual concepts are: (quotient system, subsystem), (one-element set, empty set), (homomorphism onto, isomorphism into), (direct product, free product), (spined product, amalgamated product), (inverse limit, direct limit). From a given theorem dual theorems can be conjectured. We prove some theorems on the existence of maximal congruences and show that their duals are also valid theorems. The concept of a spined product appears to be new. A spined product of the semigroups (for example) S_1 and S_2 with spine T is defined if there exist homomorphisms $\phi_i: S_i \to T$, i = 1,2 of S_i onto T when the spined product $S_1 \times^T S_2 = \{(x,y) : (x,y) \in S_1 \times S_2 \text{ and } \phi_1(x) = \phi_2(y)\}$. Thus spined product depends on the homomorphisms ϕ_1, ϕ_2, and is a subsemigroup of the product semigroup $S_1 \times S_2$. Also we have some theorems on the existence of prime ideals in semilattices of semigroups which are obtained as an application of the general methods.

Chapter III is devoted to an attempt to characterize certain semigroups in terms of their semigroups of translations.

We next investigate the structure of certain classes of idempotent semigroups. Here an essential use is made of the general concepts and of the results of Chapter III. One of our theorems determines the structure of normal idempotent semigroups: an idempotent semigroup is normal if it satisfies the identity axyb = ayxb. It is shown that S is a normal idempotent semigroup if and only if there exist a semilattice Γ and idempotent semigroups A and B such that $S = A \times^{\Gamma} B$, with the following properties. A is a left normal idempotent semigroup: axy = ayx; and B is a right normal semigroup: xyb = yxb. Further there exist congruences α, β on A, B, respectively, such that $A/\alpha \approx \Gamma \approx B/\beta$ and if α' (β') is any congruence on A (B) such that A/α' (B/β') is a semilattice then $\alpha \subset \alpha'$ ($\beta \subset \beta'$).

Microfilm $2.00; Xerox $6.60. 137 pages.

CHARACTERIZATION OF FUNCTIONS WHOSE SECOND DIFFERENCES APPROACH ZERO

(L. C. Card No. Mic 59-1137)

Uno Robert Kodres, Ph.D.
Iowa State College, 1958

Supervisor: H. P. Thielman

This dissertation was concerned with the characterization of the class of functions whose second differences approach zero uniformly in some subinterval of the real axis. A sequence of theorems was used to prove that the class of functions whose second differences approach zero uniformly at each point of a finite interval subdivides into the class of uniformly continuous functions and a class of functions which are not Lebesgue measurable.

The methods of proof which were used to prove the above sequence of theorems were found to be useful in the proof of a more general theorem. According to this theorem, the class of functions whose second differences approach zero uniformly almost everywhere in a given interval subdivides also into the class of uniformly continuous functions and a class of functions which are not Lebesgue measurable in this interval.

An example of a function was given to show that the methods of proof which were used to prove the theorems in this dissertation would be inadequate to prove "further generalizations" of these theorems. The term "further generalizations" in this context means generalizations directed towards reducing the measures of the sets on which the second differences of the functions approach zero uniformly. Microfilm $2.00; Xerox $3.00. 53 pages.

THE DIFFERENTIAL INVARIANTS OF LOCAL REGULAR SURFACE MAPPINGS

(L. C. Card No. Mic 58-7923)

Gabriel Margulies, Ph.D.
Indiana University, 1958

The linear elements $\underline{R}_\lambda = \partial\underline{R}/\partial u^\lambda$ of a surface $\underline{R}(u^\alpha)$ in real Euclidean space $\bar{E}_3$ are referred by parallel transport in E_3 to a local trihedral frame consisting of the linear elements $\underline{r}_\lambda = \partial\underline{r}/\partial u^\lambda$ and the normal $\underline{n}$ of a corresponding (u^α)-point in a surface $\underline{r}(u^\alpha)$. The resulting differential equations:

$$\underline{R}_\lambda = s^\alpha{}_\lambda \underline{r}_\alpha + z_\lambda \underline{n} \tag{1}$$

determine the mapping $(\underline{r}) \rightleftharpoons (\underline{R})$. Letting $a_{\alpha\mu}$ represent the metric tensor of the surface $(\underline{r})$, then $s_{\mu\lambda} = s^\alpha{}_\lambda a_{\alpha\mu}$ and z_λ are tensors - called mapping tensors - in the surface $(\underline{r})$ (i.e. in two-dimensional Riemann space R_2) and permit the development of an intrinsic mapping theory for surfaces embedded in E_3.

Among the principal results are certain existence and uniqueness theorems based on the set of integrability conditions for the differential equations (1). If $h_{\lambda\mu}$ designates the second fundamental tensor of the surface $(\underline{r})$, and ∇_λ designates the covariant derivative operator with respect to the tensor $a_{\lambda\mu}$ then

$$\nabla[_\mu s^\alpha{}_{\lambda]} - h^\alpha[_\mu z_{\lambda]} = 0 \tag{2}$$

$$\nabla[_\mu z_{\lambda]} + h_\alpha[_\mu s^\alpha{}_{\lambda]} = 0 \tag{3}$$

are the integrability conditions for (1). If the surface $(\underline{r})$ exists, then together with certain regularity conditions, (2) and (3) are shown to be necessary and sufficient conditions for the existence of a surface $(\underline{R})$ mapped onto $(\underline{r})$ by means of the mapping tensors $s_{\lambda\mu}$, z_λ. If k denotes the Gauss (total) curvature of the surface $(\underline{r})$, then at non-parabolic points it is shown that

$$z_\mu = 2\,{}^1\!/_k\, h^\beta{}_\mu \nabla[_\alpha s^\alpha{}_{\beta]}\,, \tag{4}$$

and hence it is shown that the mapping tensor $s_{\lambda\mu}$ determines the surface $(\underline{R})$ - when it exists - completely up to a translation in E_3 with respect to the surface $(\underline{r})$. Also, from (3) and (4) follows a single second-order differential equation for the mapping tensor $s_{\lambda\mu}$, i.e.

$$s^\alpha[{}_\mu h_{\lambda]\alpha} + 2\,\nabla[_\lambda {}^1\!/_k\, h^\beta{}_{\mu]}\,\nabla[_\alpha s^\alpha{}_{\beta]} = 0 \tag{5}$$

and it is shown that this is the immediate generalization of Weingarten's Characteristic Equation in the theory of the infinitesimal deformation of surfaces. [Here we consider $(\underline{R})$ a general deformation of $(\underline{r})$].

When neither of the surfaces is given, it is shown that it is still possible to obtain, given only a positive-definite tensor $a_{\lambda\mu}$, a quadratic tensor $s_{\lambda\mu}$ and a vector z_λ (subject to one restriction), necessary and sufficient conditions for the existence of a pair of surfaces $(\underline{r},\underline{R})$, mapped onto one another by means of $s_{\lambda\mu}$, z_λ considered as mapping tensors. These conditions are differential equations - analogous to the Gauss-Mainardi-Codazzi equations of surface theory - given in terms of a tensor $h_{\alpha\beta}(a..s..z.)$ defined in terms of $a_{\lambda\mu}, s_{\lambda\mu}$, and z_λ by: $(\bar{z}^\nu \overset{\text{def}}{=} e^{\lambda\nu} z_\lambda)$

$$h_{\alpha\beta} = \frac{e^{\lambda\mu}}{s^\alpha{}_\cdot z_\alpha \bar{z}^\nu}\,(s^\omega{}_\beta z_\alpha \nabla_\mu s_{\omega\lambda} + 2s^\omega[{}_\alpha z_{\omega]} \Delta_\mu s_{\beta\lambda} + z_\alpha z_\beta \nabla_\mu z_\lambda) \tag{6}$$

where $e^{\lambda\mu}$ is the permutation tensor in the surface $(\underline{r})$, and ∇_μ the covariant derivative operator with respect to the tensor $a_{\lambda\mu}$. In terms of the tensor $h_{\alpha\beta}$ given by (6) and the curvature tensor $k_{\omega\mu\lambda}{}^\alpha$ of $a_{\lambda\mu}$, these conditions are:

$$k_{\omega\mu\lambda}{}^\alpha - h_{\lambda\omega}h^\alpha_\mu + h_{\lambda\omega}h^\alpha_\mu = 0 \qquad (h_{\lambda\mu} = h^\alpha_\mu a_{\alpha\lambda}) \tag{7}$$

$$\nabla[_\mu h_{\omega]\lambda} = 0. \tag{8}$$

When (7) and (8) are satisfied, $h_{\alpha\beta}$ given by (6) is the second fundamental tensor of the surface $(\underline{r})$; this surface is then defined up to the usual initial conditions (i.e. translation and rigid rotation in E_3) and the surface $(\underline{R})$ is determined up to a translation in E_3 with respect to the surface $(\underline{r})$.

The intrinsic mapping theory which is developed brings also to light the role played by certain projectivities (between the tangential planes at corresponding points of the two surfaces) induced by their mapping. In particular, it leads to the solution, in intrinsic form, of the Löbell[1] - Vyčichlo[2] characterization problem for pairs of surfaces with systems of equivalent joint differential invariants. The solution is obtained by solving for the mapping tensors the differential equations (integrability conditions)(2) and (3) in a non-holonomic frame tangential to a common

conjugate net (and to its orthogonal trajectories) in the surfaces under consideration; the net, in turn, is determined by the eigen-directions of the mapping tensor $s_{\lambda\mu}$.

Microfilm $2.00; Xerox $5.00. 100 pages.

1. LÖBELL, F. Flächenabbildungen mit gemeinsamen Invarianten-system. Math. Ann. 120, pp. 21-35 (1947).

2. VYČICHLO, F. O dvojících ploch se společnými differenciálními invarianty, Matematicko-fyzikálny časopis, Slovenská Akadémia Vied, Bratislava VI, 2 (1956).

QUADRATIC ARITHMETIC IN QUATERNION ALGEBRAS

(L. C. Card No. Mic 58-7881)

Barth Pollak, Ph.D.
Princeton University, 1957

In Chapter I quaternion algebras over integral domains of characteristic $\neq 2$ are discussed. The Linnik-Pall definition of a quaternion algebra $\mathcal{A}_\nu(f)$ over an integral domain ν of characteristic $\neq 2$ based upon a non-singluar ternary quadratic form f is used. The question of equivalence of quaternion algebras is treated and the basic theorem concerning equivalence is proved. Thus $\mathcal{A}_\nu(f) \cong \mathcal{A}_\nu(g)$ if and only if Adj f and Adj g are unimodularly equivalent over ν. Using these algebras, we give a necessary and sufficient condition that two non-singular ternary quadratic forms over ν be unimodularly equivalent which is a generalization of Witt's result for fields of characteristic $\neq 2$. Quaternion division algebras are discussed. Finally, ν is specialized to a number field or a local completion and the Hasse-Minkowski Theory is utilized to give a characterization of equivalence of quaternion algebras and a characterization of division algebras in terms of the Hasse invariants c(f).

In Chapter II, the concept of integrality in quaternion algebras $\mathcal{A}_k(f)$ is discussed. The field k is assumed to possess a discrete valuation with ord $2 \leqslant 1$. Integral elements in $\mathcal{A}_k(f)$ are defined as are certain sets of integral elements called orders. Minimal bases of orders are discussed. With each order and reduced minimal basis an integral ternary g whose Adjoint is equivalent to Adj f is then associated. Isomorphism of orders in $\mathcal{A}_k(f)$ is defined and a basic theorem concerning a 1-1 correspondence between classes of isomorphic orders and Adjoint classes of integral ternary forms is proved. Finally, maximal orders are discussed and are characterized in terms of so-called Adjointly-fundamental forms.

Chapter III is devoted to the following question: given quaternions a and b in $\mathcal{A}_k(f)$, under what conditions does there exist a quaternion t such that $\bar{t}at = b$? This question is reduced to the following one: given pure quaternions a and b and scalar σ, under what conditions does there exist a quaternion t with $Nt = \sigma$ such that $\bar{t}at = b$? The basic theorem concerning solvability is proved and states that $\bar{t}at = b$ with $Nt = \sigma$ is solvable if and only if a certain binary quadratic form associated with a and b represents σ in k. Using Witt's theory of quadratic forms very simple conditions are then obtained. A relationship of fundamental importance between the conditions for solvability of $\bar{t}at = b$ with $Nt = \sigma$ and $\bar{t}at = b$ with $Nt = -\sigma$, a and b pure, is then given. Finally, the field k is specialized to a number field and its local completions k_ρ. If $Na \neq 0$, it is shown that, in the case $c_\rho(f) = 1$, $\bar{t}at = b$ with $Nt = \sigma$ and $\bar{t}at = b$ with $Nt = -\sigma$ are both solvable or both unsolvable in $\mathcal{A}_{k_\rho}(f)$ while in the case $c_\rho(f) = -1$, exactly one of these equations is solvable. Motivated by this theorem, certain symbols $[a,b]_\rho$ are defined and a reciprocity law is proved.

In Chapter IV the field k is assumed to be a local field with 2 a unit or a prime. The chapter is devoted to the following question: given quaternions a and b in a maximal order $\mathcal{M}$ of $\mathcal{A}_k(f)$, under what conditions does there exist a quaternion t in $\mathcal{M}$ such that $\bar{t}at = b$? This question is reduced to the following one: given pure a and b in $\mathcal{M}$ and σ in ν, the valuation ring of k, under what conditions does there exist a quaternion t with $Nt = \sigma$ such that $\bar{t}at = b$? Necessary and sufficient conditions are given. However, in the case 2 is prime, the assumption $c(f) = -1$ is made. A relationship between the conditions for solvability of $\bar{t}at = b$ with $Nt = \sigma$ and $\bar{t}at = b$ with $Nt = -\sigma$ akin to that of Chapter III is given. Finally, we assume k is a number field and as in Chapter III define certain symbols $\{a,b\}_\rho$ and in terms of them prove a reciprocity law which generalizes the result of O'Connor-Pall.

Microfilm $2.00; Xerox $3.80. 68 pages.

DOMAINS OF POSITIVITY

(L. C. Card No. Mic 58-7884)

Oscar S. Rothaus, Ph.D.
Princeton University, 1958

A Domain of Positivity D is an open convex cone in E^n, associated with a non-singular symmetric matrix S, called a characteristic, such that $x \in D$ if and only if $xSy' > 0$ for all $y \in \bar{D}$. They were introduced by M. Koecher [14]* in generalization of the cone of positive definite matrices studied by Siegel [17].

The automorphisms of D are the group G of non-singular matrices mapping D onto itself. D is called homogeneous if G is transitive on D.

A Riemmanian metric invariant with respect to G may be introduced into D. And if D is homogeneous, it is possible to construct an involution of D which is compatible with G.

In this paper we concentrate primarily on homogeneous domains. If we suppose the characteristic S to be positive definite, then the first fact that emerges is that D is a symmetric space in the sense of Cartan [9]. It is then possible to make a detailed study of the Lie algebra of G, and the following facts are elicited:

i) D has non-positive curvature.

ii) There is a unique geodesic connecting any two points of D.

iii) The so-called "Gamma Factor" of D is essentially a product of Gamma functions.

Another important fact revealed is that the involution of D extends to a holomorphic involution of T_D, the tube in the space of n complex variables with D as base. It is then easy to show that T_D is equivalent to a Bounded

Symmetric Domain in the sense of Cartan[7]. We show, in addition, that D is of necessity a Cartesian product of "irreducible" Domains of Positivity. And if D is irreducible, then T_D is irreducible in the sense of Cartan[7].

It is also possible to determine explicitly the Bergman Kernel Function[1] of T_D. The construction here is valid for all homogeneous Domains of Positivity, whether they have positive definite characteristic or not.

Bibliography

[1] Bergman, S: The Kernel Function, Amer. Math. Soc. Survey #5, 1950.

[7] Cartan, E: Domaines bornés homogènes de l'espace de n variables complexes, Abhandlung aus dem Math. Sem. der Hamburgischen Univ., Vol. 11, pp. 116-162, 1935.

[9] Cartan, E: Les espaces riemanniens symétriques, Verhandlung des Internationalen Mathematiker Kongresses Zurich, 1932, Vol. 1, pp. 152-161.

[14] Koecher, M: Positivitätsbereiche im R^n, Amer. Jour. of Math. Vol. 79, No. 3, 1957, pp. 575-596.

[17] Siegel, C. L: Symplectic Geometry, Amer. Jour. of Math., vol. 65, No. 1, 1943, pp. 1-86.

Microfilm $2.00; Xerox $4.40. 84 pages.

*Numbers in brackets refer to the bibliography at the end of the paper.

STUDIES CONCERNING (A) VANISHING ALGEBRAS AND (B) CYCLIC ELEMENTS

(L. C. Card No. Mic 58-1969)

Arthur Bernard Simon, Ph.D.
Tulane University, 1957

Chairman: Fred B. Wright

(A) Let G be a locally compact Abelian group and let S be any measurable subset of G. We denote the group algebra of G by $L^1 = L^1(G)$. Set $L_S = \{f \in L^1 : S \text{ is a support for } f\}$ and $D_S = \{x \in G : \text{every open set about } x \text{ meets } S \text{ in a set of positive measure}\}$. If L_S forms an algebra, we call it a vanishing algebra. It is shown that if S is a semigroup, then L_S is a vanishing algebra and if L_S is a vanishing algebra, then D_S is a closed semigroup. If G is compact and L_S is a vanishing algebra, then S is a closed group a.e. Some properties of the (Fourier) transforms of vanishing algebras are also exhibited.

(B) Let X be a compact Hausdorff space and let T be a closed subset of X with the property that $H^n(B) = 0$ whenever B is a closed part of T. We call T a T^n set. An n-cyclic element K is a closed non-degenerate subset of X such that K is not disconnected by the omission of any T^n and K is maximal with respect to this property. We show that, under certain conditions, the cohomology of X, in dimension n+1, say, is completely determined by the cohomology of its n-cyclic elements. We also determine the co-dimension of n-cyclic elements.

Microfilm $2.00; Xerox $3.60. 62 pages.

SINGULAR PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS WITH TIME DEPENDENT COEFFICIENTS

(L. C. Card No. Mic 58-7667)

Doris Grove Skillman Stockton, Ph.D.
Brown University, 1958

In this paper we discuss the equation

$$(1)\quad u_t(x,t) = D_{\mu_t} D_{\sigma t} u(x,t) + c(x,t)u(x,t), \qquad a \le t \le b,\ r_1 \le x \le r_2,$$

where for each t μ_t is a Borel measure defined on the Borel sets of (r_1, r_2), σ_t is a strictly increasing function continuous on (r_1, r_2), u(x,t) and c(x,t) are elements of the Banach space $C[r_1, r_2]$, $c(x,t) \leqq 0$ and the derivative appearing on the right-hand side is a derivative first with respect to σ_t and then with respect to μ_t. The purpose is to exhibit conditions on μ_t and σ_t such that given an initial value for t = a and possible boundary conditions the solution will be determined uniquely. The boundary classifications are those of H. McKean [4] in accordance with W. Feller [1], and the boundary conditions are the so-called "classical" ones.

We associate with each operator

$$\Omega(t) = D_{\mu t} D_{\sigma_t} + c(x,t)$$

the Banach space X which is either $C[r_1, r_2]$ or a particular subspace of $C[r_1, r_2]$ consisting of functions vanishing at one or both endpoints of $[r_1, r_2]$. Then the domain of $\Omega(t)$ is defined to be the set of all $f \in X$ which satisfy the appropriate boundary conditions and which are such that $\Omega(t)f$ is itself in X.

The differential equation (1) is a special case of the so-called equation of evolution treated by T. Kato [3], and our purpose is accomplished by determining conditions on σ_t and μ_t which will guarantee that $\Omega(t)$ satisfies Kato's hypotheses. We have supplanted Kato's set of hypotheses by a set of conditions which are slightly stronger than Kato's although somewhat more convenient for applications to differential equations.

It is noted that the classical operator

$$(2)\qquad A(t) = a(x,t)\frac{d^2}{dx^2} + b(x,t)\frac{d}{dx} + c(x,t)$$

where $a(x,t) > 0$ and a(x,t) and b(x,t) are continuous on the open interval (r_1, r_2) for each t is a special case of $\Omega(t)$. The conditions implying the existence of a unique solution of equation (1) are examined for the particular case of the equation

$$(3)\qquad u_t(x,t) = a(x,t)u_{xx}(x,t) + b(x,t)u_x(x,t) + c(x,t).$$

The results presented here for the classical case are compared with those results previously obtained by W. Feller [2]. It is observed that our conditions permit the coefficient b(x,t) to be discontinuous in x for each t at the boundaries, whereas Feller's conditions require that for each t b(x,t) is continuous for all real x. The method of proof which we use excludes the possibility of using boundary conditions dependent on t. Several examples of equations of type (3) whose coefficients satisfy our conditions are included.

Bibliography

1. W. Feller, The parabolic differential equations and the associated semi-groups of transformations, Ann. of Math. (3) vol. 55 (1952) pp. 468-519.
2. _____, Zur theorie der stochastischen prozesse, Math. Annal. vol. 112 (1936) pp. 113-160.
3. T. Kato, Integration of the equation of evolution in a Banach space, J. Math. Soc. Japan vol. 5 (1953) pp. 208-234.
4. H. P. McKean, Jr., Elementary solutions for certain parabolic partial differential equations, Trans. Amer. Math. Soc. (2) vol. 82 (1956) pp. 519-547.

Microfilm $2.00; Xerox $3.00. 59 pages.

STATISTICAL SAMPLING FOR SOIL MAPPING SURVEYS

(L. C. Card No. Mic 59-1148)

Howard Lewis Taylor, Ph.D.
Iowa State College, 1958

Supervisors: H. O. Hartley and Gerhard Tintner

The problem considered in this study was the determination of an optimum sampling design to provide the basic information required for a national inventory of soil and water conservation needs. In particular, the optimum size of sampling unit was determined and methods were developed for estimating acreages of various soil classifications for each county.

The decision regarding the optimum size of sampling unit was based primarily on evidence about the variability of different-sized units and information about the cost per unit. The approach taken in regard to an optimum sampling unit was to establish a variance function showing the relationship between variance and size of unit and a cost function indicating how costs change with size of unit. Based on these two functions, an expression was obtained for the optimum size of unit. The procedure used was to determine the size of unit which gave estimates with minimum variance for a certain fixed expenditure. In this connection, certain homogeneity considerations were also examined.

The recommended size of sampling unit was different for different types of land. For irrigated land a 40-acre unit was the optimum. For general farming and dry farming land a unit of 160 acres was preferred. A 640-acre unit was recommended for range land.

Several different estimators were considered for possible use in the estimation and tabulation phase of the project. The estimator suggested for general use was a ratio estimator having total acreage as the auxiliary variate. Various other estimators were considered for special problems.

Two types of problems involving the pooling of data from similar areas were considered. One estimator based on a pooling procedure appeared to offer considerable reduction in the variance of county estimates.

Other estimation problems which were examined included the utilization of information from outside the sample, the estimation of the acreage of present land use when complete data from a previous mapping were available, and a special problem regarding subsampling.

Although complete variance formulas for the estimators were developed and evaluated in key examples, a short-cut method in graphical form, giving approximate values for relative standard errors, was presented for general use.

Microfilm $2.00; Xerox $6.80. 143 pages.

MULTIPLE SCATTERING OF WAVES

(L. C. Card No. Mic 58-7671)

Peter Cary Waterman, Ph.D.
Brown University, 1958

Governing equations are obtained for the problem of multiple scattering of waves in a homogeneous isotropic medium containing a statistical array of scattering regions. The equations are applicable to sound waves in solids, liquids and gases, electromagnetic waves, and stationary quantum-mechanical problems. From these equations the macroscopic properties of the "scattering medium" may be obtained in terms of the scattering properties of a single scatterer. Questions of energy and measurement are discussed, and several examples are considered. An extension of the theory to the elastic problem with mode conversion present is included.

Microfilm $2.00; Xerox $4.20. 78 pages.

CONCERNING DENSE METRIC SUBSPACES OF CERTAIN NONMETRIC SPACES

(L. C. Card No. Mic 59-185)

James Newton Younglove, Ph.D.
The University of Texas, 1958

Supervisor: R. L. Moore

In this dissertation the author shows that each space satisfying R. L. Moore's Axioms 0 and 1 contains a complete metric subspace dense in the original space. This is accomplished by showing that if α is an Axiom 1 sequence, i.e. a sequence of collections of regions with the properties stated in Axiom 1, then the set M_α, consisting of all points where α has the properties stated in Axiom C, is an inner limiting set dense in space.

Suppose M is a point set and it is true that if G is a collection of domains covering S, then there is a collection Q of domains covering S such that each domain of Q is a subset of some domain of G and further, if P is a point of M and $q_1, q_2, q_3, \ldots$ is an infinite sequence of distinct domains of Q and for each positive integer n, A_n is a point of q_n and B_n is a point of q_n and the sequence $A_1, A_2, A_3, \ldots$ has P as a sequential limit point, then the sequence $B_1, B_2, B_3, \ldots$ has P as a sequential limit point. The point set M is said to possess Property Q.

It is shown that if M is a point set possessing Property Q, then there is an Axiom 1 sequence α such that M is a subset of M_α. From this it follows that every paracompact space satisfying Axioms 0 and 1 is metric.

It is also shown that if M is an inner limiting set dense in space and there is an Axiom 1 sequence α such that M_α contains M, then there is an Axiom 1 sequence α' such that M is $M_{\alpha'}$. Microfilm $2.00; Xerox $3.00. 26 pages.

THIRD RELATION IN THE LATE EIGHTEENTH AND EARLY NINETEENTH CENTURIES

(L. C. Card No. Mic 58-7921)

Ronald Francis Jesson, Ph.D.
Indiana University, 1958

The term "third-relation" is one which is frequently used to describe a key scheme found to be somewhat common in the compositions of the nineteenth century. This type of key relationship brings into close affiliation keys whose tonics are a third apart, but which are considered to be foreign to one another in other respects.

An attempt has been made to formulate a concept of third-relation based on observations made from its use in practice, and also drawing upon existing theories relevant to the practice. Materials used for the observation of its practice are the piano sonatas of the following composers: Haydn, Mozart, Beethoven, and Schubert. Compositions written in sonata form reveal that the elements in formal structure are delineated by the use of contrasting tonalities. Though some notice is given to key relationships from one movement to the next, it is the use of contrasting key schemes within sonata movements upon which the formulation of a third-relation concept is made.

The tonal development and expansion in the nineteenth century probably had its first roots in the assimilation of chords into the major mode from the corresponding minor mode. The enlargement of the harmonic dimension by modal exchange resulted in the enlargement of the tonal relationships by the same means. The application of change of mode, first, on the tonic, and secondly, upon individual scale degrees is the point of departure for the formulation of an approach to the study of third-relationship.

Third-relationships which come about as the result of a change of mode affecting the primary functions are classified as first-order third-relationships. Digressions from the tonic to the flatted major mediant and the flatted major submediant are the first-order third-relationships appearing with greatest frequency in the sonatas of both Beethoven and Schubert. Tonicization of the major chord on the flatted seventh degree and the flatted second degree, the remaining first-order third-relationships possible, appear with lesser frequency in the sonatas of Schubert but not at all in those of Beethoven.

Third-relationships which come about as the result of a change of mode affecting the secondary functions are classified as second-order third-relationships. In the sonatas analyzed they appear with less frequency than those of first-order; those that do occur appear in the sonatas of Beethoven with one exception occurring in a sonata by Schubert. Second-order third-relationships appear only as the major submediant and the major mediant, though theoretically the major supertonic and the major chord on the leading tone can appear as third-relationships also.

Studies of the use of third-relationships in practice show that Haydn and Mozart did not use it all within movements or sections, but adhere to the tonic-dominant relationship. Beethoven and Schubert, on the other hand, not only used third-relationship key schemes independently, but also as digressions in tonic-dominant relationships. In most cases the change of mode step is present as a modulatory technique, indicating the fact that Beethoven and Schubert both effect third-relation key changes by means of modal exchange. Microfilm $2.25; Xerox $7.80. 170 pages.

THE SCIENTIFIC RATIONALE OF VOICE PRODUCTION MADE APPLICABLE IN PRINCIPLE AND METHOD TO THE TEACHING OF THE COLLEGE VOICE CLASS

(L. C. Card No. Mic 59-654)

Abel John Peterson, Ed.D.
University of Oregon, 1959

Adviser: Robert E. Nye

In light of the diversity of opinions and controversial explanations concerning the subject of voice production and its pedagogy, it was assumed that any study of voice undertaken by prospective teachers of music should be rooted in factual knowledge as derived from scientific findings and conclusions as they pertain to the singing act.

Data for the study were from two sources, a comparative analysis of the findings in the field of acoustics as they relate to the nature and source of vocal tone and a study of the physiology involved in the singing act.

The major areas involved in the singing act were organized as follows: (1) vowels; (2) consonants; (3) structure and vocal functions of the larynx: and (4) breath supports.

In order to circumvent the problem of isolation in the respective areas of study, there was a coordination of the interdependency and interrelatedness of the physical determinants of each factor within and between the respective areas.

A cumulative treatment with resultant conclusions from chapter to chapter insured that the areas under consideration would be seen to be a part of a compository set of interactive forces, any of which are capable of affecting voice quality.

An investigation of the vowel sounds revealed that their proper formation and characteristic quality will depend largely upon their degree of rapport with the laws of cavity resonance. It was found that the manipulation of determinants--jaw, tongue, and lips--in altering the size of the mouth cavity and its aperture, will affect not only the quality of the vowel but will prescribe what vowel shall be sung. It was concluded that rules for vowel formation can

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

be stated simply, directly, and at the same time be consistent with acoustical foundations upon which they are predicated.

Principles of consonant classification and articulation were based on the following conclusions: (1) that their essential characteristics can be identified by the pitch of their resonances; (2) that consonants do not differ from each other in kind but in degree of resonant characteristics; (3) that since consonants are links to vowel sounds and cannot properly be considered apart from them in the contextual setting of a song, their functions are interrelated and interdependent.

An investigation of the vocal function of the larynx revealed phonation to be the result of a highly complex network of interacting intrinsic muscles. It was found that interference from extrinsic muscles and pharyngeal constrictors imposes an imbalance of dynamic muscular tension within the larynx which is detrimental not only to glottal tone, but which affects adversely the resonance column above the larynx. As a means of avoiding this, the principle of laryngeal passivity was set forth on premise that since it permits the vocal bands to adjust to the proper tension, uninhibited by the constricting effect of extrinsic laryngeal muscles and pharyngeal constrictors, the cavity space above the larynx is thereby increased, effecting better quality of vowels and efficiency of consonant articulation.

As derived from scientific findings, the principle of diaphragmatic-abdominal muscular antagonism was set forth as the most efficient means whereby a synchronization of balance between the contraction of the muscles of breathing and a balance of intrinsic laryngeal tension can be maintained.

The application of derived principles was accomplished by means of cumulatively treating the areas of involvement in a sequence of illustrative vocal exercises designed to solve specific vocal problems.

With due consideration to the specific conclusions which were inherent in the delineation of vocal principles, it can be said that the present study justifies the general conclusion that scientific findings can be utilized in the development of vocal principles and methods of applying them when this refers to known facts which can be applied at the level of conscious control.

Microfilm $2.00; Xerox $6.80. 144 pages.

PHILOSOPHY

EDUCATIONAL IMPLICATIONS IN THE PHILOSOPHY OF N. O. LOSSKY

(L. C. Card No. Mic 59-382)

Alex Hetko, Ph.D.
The Ohio State University, 1958

N. O. Lossky is a Russian philosopher whose philosophy reveals the thought of the Eastern philosophic tradition, yet also contains significant elements from Western thought. In developing a theory of education from N. O. Lossky's philosophical thought, I have found that Lossky's philosophy can be classified as ideal-realism and that the educational theory derived from it might be called Christian Realism.

As a Christian philosophy of education it is based upon two Christian principles: (1) love of God and (2) love of neighbor. A third concept which runs through his general philosophy is "sobornost." "Sobornost" is also reflected in the educational theory. Lossky would agree with the current Russian theological view concerning "sobornost."

Unlike the common concept of Christian Realism, Lossky's theory is monistic, not dualistic. Looking into Lossky's works we see the world as ultimate reality is not both mind and body but spiritual substances which he calls substantival agents. Every substantival agent is a person, either actual or potential; i.e., it can develop and become an actual personality. Every substantival agent is a supertemporal and superspatial ego (self). Lossky's metaphysics is therefore a kind of personalism, like the metaphysics of Leibniz, in which he affirms that the world consists of monads which are actual or, at least, potential persons.

Mind and body are processes of these spiritual substances or substantival agents. As processes they are activities of a multitude of substantival agents which form the mind or body. Mind and body are not eternal, therefore, but exist as activities or manifestations of the substantival agents. The mind activity is in time and is revealed in such expressions as wishes, desires, feelings, etc. The material body activities are in both time and space and are revealed in such expressions as attraction and repulsion.

Lossky's epistemology is intuitivism. This is a theory of knowledge according to which the knowing subject perceives immediately not only his own feelings and desires but also the objects of the external world.

Education is related to knowledge; it aids in the process of attaining fulness of being (life). Education is a means of helping the individual to actualize his creativeness through experience which reflects freedom and purposeful activity. It is a process of growing mentally in the knowledge of those values which promote fulness of being.

In Lossky's philosophy "sobornost" implies the combination of unity and freedom as expressed by mankind on the basis of a common love for God and for all absolute values, as each individual expresses his unique love for God when he attains fulness of life or being. This love is expressed by means of creative activity which would be impossible without individual freedom. This is to say that the more creative the individual is in his activities, the more freedom he possesses and vice versa.

When individuals combine their efforts of creative activity in their expression of love for God and the absolute values in their approach to fulness of life, these concerted efforts form a family or community of a free and concerted creative activity in which the principle of love of neighbor becomes a living expression of the reality of love.

It is in the fulness of being that Lossky differs from

the Western tradition in the Platonic sense of absolutes. What Plato calls absolutes and ultimate reality–space, time, number, etc.–are merely abstract for him, but for Lossky they are ways of acting for all substantival agents. Lossky's ultimate reality is not abstract but concrete. The concrete as fulness of being goes beyond the abstract.

Lossky's philosophy in terms of the concept of absolutes, therefore, is unlike the philosophy found in the Western tradition. However, he does borrow from the Western or Platonic tradition. His philosophy, in general, combines Plato and Leibniz, but his followers feel that he goes beyond both of these philosophers.

Microfilm $2.30; Xerox $8.20. 176 pages.

ST. THOMAS AQUINAS ON THE PRINCIPLE OF SUBSISTENCE

(L. C. Card No. Mic 58-7100)

Robert Joseph Perillat, Ph.D.
University of Notre Dame, 1958

Supervisor: Rev. Peter O'Reilly

In a Metaphysics admitting a plurality of beings it is necessary to explain the ultimate principle of distinction, of one being from another. No two beings which are being in the full and proper sense communicate with one another in being. In existing they must be simply diverse and this diversity must be rendered intelligible.

In Aristotelian metaphysics the ultimate principle of difference lies in the order of substance. In material beings it is the matter and individuating accidents that account for the plurification of the common nature. In the order of separated substances the diversity arises in the forms themselves, each individual differing from every other in species.

This explanation, while adequate to the solution of many philosophical problems, becomes inadequate in the light of the Revelation that Christ's human nature, though complete and individual, is lacking in the perfection of being a person or supposit. Something more than matter is needed to constitute human nature an individual in the full and proper sense.

Cajetan ignored the existential solution of this problem found in St. Thomas and attempted to solve this problem by forcing the teaching of Aristotle to imply a principle of difference between per se existence and existence per se separatim. The reasons Cajetan has done this are clear, although complex. Basically Cajetan's error is to speak of supposit or person in the order of potency rather than in act. The positive difference of existence is for Cajetan something entirely extrinsic to the constitution of person because he understands person to formally signify what is receptive of existence instead of what has existence.

There seems to me ample evidence in the writings of St. Thomas that supposit or person properly signifies being in act, and that while existence is truly other than the quod est or subject, it is nonetheless essential to the subjects being a person or supposit.

The Capreolean tradition has long recognized this distinction essential to this problem, designating it as the distinction between a term taken denominatively and a term taken according to its ratio or definition.

The dissertation is divided into four major parts. The first part is a defense of the central significance of the Quodlibet II, q.2, a.2, teaching that the principle of difference between nature and supposit in angels is the act of existence. Cajetan's criticism of this text to the effect that St. Thomas intended existence as only an extrinsic and not as an essential difference is shown to be without foundation. The Quodlibet teaching is shown to be a further penetration into the meaning of supposit by St. Thomas in the light of his own existential metaphysics. The second part of the dissertation is entirely devoted to the position of Cajetan and the adherents to his thought on the problem. An attempt is made to avoid criticism of this school during the presentation of their thought. In the third part of the thesis the variant interpretations of Capreolus's thought are studied, and the conclusion is arrived at that the interpretation of Billot is faithful to the truth of Capreolus' teaching. The concluding fourth part of the dissertation consists in a criticism of certain fundamental errors in the Cajetan position and reviews the position of Capreolus in the light of further evidence gathered from our own study of the writings of St. Thomas showing that for St. Thomas the act of proportionate existence is included intrinsically in the meaning of the terms supposit and person. Microfilm $4.50; Xerox $15.00. 349 pages.

PROCESS AND CAUSALITY: WHITEHEAD'S REPLY TO HUME

(L. C. Card No. Mic 59-739)

Jack Pustilnik, Ph.D.
Columbia University, 1958

My thesis is that process philosophy in general and the philosophy of organism of Alfred North Whitehead in particular contain a conception of causality that may hope eventually to replace the sceptical view of causality promulgated by David Hume in the 18th century, but which remains, even today, a potent force in philosophy.

After analyzing Hume's theories, I take it as my first major task to locate those characteristics which Hume felt nature would have to exhibit in order to invalidate his view of causality. Of course, Hume did not think that nature exhibited these characteristics; therefore, he challenges us to find them (if we hope to refute him). In effect, he challenges us to provide an ontology showing that: (1) events are connected to other events; (2) the individual event, and not only many similar repetitions of it, can be determined to be a cause or an effect; (3) the qualities and powers which make events into causes are sensible; (4) objects discerned in events exist continuously; (5) the production and, hence, the causation of one event by another consists of something more than the repeated temporal succession of contiguous events; (6) events allow inferences about other events; and (7) future events will resemble past or present events.

Turning to Aristotle, considered by some to be the model of a process philosopher, I find that he contradicts Hume on the essential points of those above. Since there can be no refutation without such a prior contradiction, it would appear that process philosophy can replace Hume, if its assertions about the structure of nature are verified. Aristotle contradicts Hume on the challenges largely by

contending that substances exist in nature, i.e., that things like men, trees, and horses are able to retain their self-identities while undergoing various kinds of changes. However, the existence of these substances, for Aristotle, is only an assumption; hence his thought contradicts Hume's but does not refute it.

Finally I examine Whitehead's system. I argue that it provides for recognizable identity amidst change, though what is identical, for Whitehead, is always a perceptual pattern (an actualized possibility) rather than the persistent substances of Aristotle's philosophy.

Yet Whitehead's "continuously repeated patterns" enjoy the advantage over Aristotle of dispensing with the postulate of direct interaction (traditional efficient causality) among different enduring patterns in order to explain the existence of these patterns. The existence of the pattern of an enduring object at any moment is explained by Whitehead as deriving from the actual entities constituitive of this same pattern at the just preceding moment. Hence Whitehead stresses what I call "self-causation," where the "self" is constituted by the succession of entities which actualize an enduring pattern, rather than stressing "other-causation," for this would pertain to the influence upon one pattern by the entities constituting a different pattern.

Hume was sceptical about the presence of causality because he could not find in nature the force or power efficient (other) causes were supposed to exert. Hence Whitehead's explanation of change without recourse to traditional efficient causes marks a real advance over Aristotle, by not requiring these unperceivables.

However, Whitehead's system, like Aristotle's, is largely a priori. He does not demonstrate that such self-causality exists but only postulates it. Hence Whitehead's reply is not a refutation. But, by having shown that existence and change may be explained without reference to unperceivable forces or powers, Whitehead points out a new path that may very well mark the turning point in causality theory after Hume.

Microfilm $4.25; Xerox $14.40. 331 pages.

THE SPECULATIVE THEOLOGY OF THE NINETEENTH CENTURY. A CRITICAL EVALUATION OF ITS POSITION AND ITS SIGNIFICANCE FOR THE TWENTIETH CENTURY WITH SPECIAL REFERENCE TO THE WORKS OF CARL DAUB AND PHILIPP MARHEINEKE.

(L. C. Card No. Mic 59-743)

Werner August-Wilhelm Rode, Ph.D.
Columbia University, 1958

A critical evaluation is made of the attempt of a speculative restoration of orthodox Christian dogma by Hegel's right-wing pupils Carl Daub and Philipp Marheineke, and of the significance of the speculative principle within German idealistic thought for certain fundamental issues in the present day theological discussion in Germany.

It was the intention of the "old" Hegelian school, of which Daub and Marheineke are the two outstanding representatives, to save the content of Christian doctrine and dogma from the realm of obscurity into which they were banned by rationalism and supernaturalism at the end of the eighteenth century. Daub and Marheineke conceived their philosophical and theological striving as an answer to a supposedly all consuming criticism. Their life's work took the form of a consistent presentation of Christian dogma in philosophical form.

Carl Daub was born on March 20, 1765 in Kassel, Germany. In 1786 he began his studies in Marburg in philosophy and theology and after their completion stayed on to establish himself as a teacher in both academic disciplines. He received a call from the University of Heidelberg in 1795, inviting him to join the theological faculty. He answered this call with forty-one years of diligent work and devoted service. Three main periods mark the academic development of Daub's career. The early influence of Kant is clearly dominant in a collection of sermons based on Kantian principles, 1794. His decided affiliation with Schelling, which marks the second period of his thought, was revealed in his Theologumena 1806, and in the closely related Introduction to Christian Dogmatics, 1809. Daub fights a "life and death struggle" with Hegel's philosophy in a collection of essays on the problem of evil called Judas Ischariot, a struggle in which Hegel was victorious and became decisive during the final period of Daub's life work.

Philipp Konrad Marheineke was born May 1st, 1780 in Hildesheim. He became professor and second preacher at the university church of Erlangen in 1805, two years later joining his friend Daub at the theological faculty in Heidelberg. In 1811 he accepted a call to the University of Berlin, where he taught until his death, May 31st, 1846. Marheineke like Daub first followed Schelling in his philosophical interests and later Hegel. The various editions of Marheineke's dogmatics, 1819 and 1827, and his system of dogmatics edited by Matthies and Vatke, 1847, are a witness to this development and Marheineke's viewpoint.

The introductory chapter of the thesis on speculation in the idealistic systems of the late eighteenth century is followed by a presentation of Daub's dogmatics as developed under the influence of the early Schelling. Daub's Introduction to Dogmatics and his Theologumena are discussed with special reference to the nature, existence, and attributes of God. Daub's thought in transition from Schelling to Hegel is shown in his Judas Ischariot, a speculative unfolding of the problem of evil. The aporia in which Daub found himself in this work made him accept the Hegelian position.

Marheineke's understanding of the importance of the Hegelian philosophy for theology is used to illustrate this change in both Daub and Marheineke's dogmatic thinking. The presentation of Daub's system of dogmatics based on Hegel, forms the third part of the thesis. In his Prolegomena Daub develops dogmatics from the standpoint of the Bible, religion, and speculation. In his system proper, the content of dogmatics divides itself according to the self-movement of the concepts within Hegel's dialectical method. The divisions are: the doctrine of God as the self-differentiation of absolute Spirit (God the Father), as differentiated Spirit (God the Son), as one in His differentiation (God the Spirit).

Since such speculative dogmatics were conceived as an all embracing system, the question: Is there a "beyond speculation"?, seems appropriate for the next chapter. Here Schelling's re-appearance on the philosophical scene during the early 1840's, mostly as a Hegel critic, is

observed in an evaluation of Schelling's new "positive" approach by Marheineke. Schleiermacher, Strauss' criticism of Schleiermacher and Daub, are also considered here. A view of the speculative principle as an unsuppressible factor in the subsequent theological and philosophical development concludes the main chapter of the thesis.

The affirmation of speculation within the German theology of the twentieth century forms the conclusion. An attempt is made to show the speculative principle as it became effective in the struggle against historism and naturalism, as in the thought of Troeltsch and Tillich. A final consideration is given to the possible importance of metaphysical theology in the overcoming of the stalemate of the present day discussion of the problems concerning the demythologization of the New Testament.

Microfilm $2.35; Xerox $8.20. 179 pages.

THE NATURE OF McTAGGART'S THEORY OF APPEARANCE

(L. C. Card No. Mic 58-7886)

Jerome Borges Schneewind, Ph.D.
Princeton University, 1957

When we try to take McTaggart's uses of the key metaphysical terms, "appearance" and "reality," as clues to their meanings, we find a serious problem. For although McTaggart at first says that appearances do not exist, he later insists that they do exist, and must be accounted for. Detailed examination of his careful accounts of specific appearances - judgments, inferences, assumptions, images, sense-data, matter, time - reveals that the seeming inconsistency can be removed. When he denies the existence of appearances, he is denying only that our present experience has the forms it seems to have. His accounts are attempts to show that all the contents of present experience have the forms which we usually think belong only to selves and perceptions, which, he says, are alone real. Appearances and Realities, on his view, are the same substances, divided however in different ways - in different "dimensions."

McTaggart's assertions and denials of existence must thus be taken to concern, not particular things, but general categorizations of particular experiences. In saying that there are selves and perceptions, and that there are not physical objects, sensa, changes, etc., he is telling us how we should categorize the bare and undeniable data of our experience. He rejects the categorization imposed by "the unconscious metaphysics of ordinary language," and tries to show that his own set of categories is better. His theory is thus not empirically refutable, since it is a construction of a categorial system; nor is it wholly a priori, since the categories must be shown to be sensitive to the data, and adequate to cover the data entirely.

Why, then, does he argue for one system of categories and against another? To answer this question a suggestion is made concerning the nature of metaphysics. It is suggested that the basic aim of metaphysical system is not the discovery or conveyance of new empirical data, or of new scientific laws. Its aim is rather to show that the universe contains only objects of such a nature that certain very general attitudes are appropriate and justifiable toward them. This is not mere "expression of emotion," as some positivists have thought; it involves argument and the giving of reasons, despite the fact that its results are neither factual statements, nor empirical laws, nor tautologies. In constructing his categorial system the metaphysican indicates what attitudes are appropriate; in showing their applicability he shows that the attitudes are appropriate.

We may then say that "appearance" and "reality" are used, in metaphysical systems, primarily to indicate absence or presence in a given category or set of categories. This is similar to one of their uses in ordinary language. Calling things of a certain description "appearances" indicates that, as so described, the things do not fit into the preferred categorial system; calling things of a different description "realities" indicates that as so described the things do fit into the system. Various traditional criteria for the adequacy of a metaphysical system can be seen to be valid criteria on this account of metaphysics, but it must be noted that the value of a metaphysical system does not depend on its turning out to be the sole correct theory, since a variety of insights may be obtained even from less than perfect systems.

Microfilm $3.35; Xerox $11.40. 257 pages.

AN ANALYSIS OF SANTAYANA'S ONTOLOGY AND EPISTEMOLOGY IN THE LIGHT OF HIS DISTINCTION BETWEEN ESSENCE AND EXISTENCE

(L. C. Card No. Mic 58-7893)

Guy Weston Stroh, Ph.D.
Princeton University, 1957

Santayana's philosophy today remains as one of the few comprehensive and consistent philosophies of the Twentieth Century. And, even though it was composed in a literary form that often seems to hide and scatter its argumentation, it is to be judged as a system of philosophy (as it was intentionally composed as such). The ontological character of Santayana's philosophy represents its systematic aspect and the distinction between essence and existence stands at the focal point of this ontological system. In the first chapter of this thesis I have attempted to analyze this distinction with a view to expunge certain difficulties that seem to me to constitute or bring to light the major defects in Santayana's philosophy. I argue that the distinction between essence and existence represents an illicit hypostatization of a purely logical notion and a failure on Santayana's part to distinguish logical and empirical identity. Santayana's illicit opposition of essence and existence produces acute ontological and epistemological difficulties in his system. However, at the same time his absolute opposition of essence and existence provides him with readymade device for the premature solution of many traditional philosophical problems. I have attempted to show in particular how the problem of knowledge is stated and solved by Santayana in terms of the distinction between essence and existence. The emergence of scepticism in his analysis to state this problem depends upon a doctrine of the given that I argue is totally irrelevant to experience. The emergence of animal faith in his analysis to solve this problem depends directly upon a solipsistic argument and

a doctrine of substance which I argue are completely inadequate to render an adequate solution to any significant epistemological problems. However, I go on to argue that perhaps the worst aspect of Santayana's analysis here consists in the subtle manner in which the total abnegation of any further analysis of these problems becomes an inevitability. Because Santayana is entirely consistent in carrying out the implications of his rigid distinction between essence and existence, there is no way in which his philosophy could be successfully modified without giving up this distinction and all the rigid dichotomies that follow from it. In this light I have tried to show how Santayana's philosophy trivializes and falsifies the analysis of certain traditional ontological and epistemological problems.

In the last chapter I consider the peculiar case of ontological incompleteness that is involved in Santayana's system. There I argue that his doctrine of materialism is based upon an inadequate concept of matter and that his materialism suffers because of his illicit hypostatization of logical identity into a realm of essences. I also try to show briefly how Santayana's analysis of value is encumbered by his unsatisfactory explication of the concept of existence. Finally, I give brief consideration to Santayana's appraisal of religion in terms of his own adopted form of naturalism. There I try to point out that Santayana fails to make a clear distinction between religious faith and his own concept of animal faith, thus leaving the whole concept of faith inadequately analyzed. This indicates something important regarding Santayana's own brand of naturalism that is not usually noticed - that it is a closed, a priori doctrine which does not stand to benefit from any further refinement in analysis or findings in the positive sciences. This suggests that the ontological categories upon which Santayana's philosophy is based undermine the naturalistic orientation of his thought.

Microfilm $2.10; Xerox $7.40. 158 pages.

PHYSICS

PHYSICS, GENERAL

ANGULAR DISTRIBUTIONS OF DEUTERONS FROM REACTIONS INDUCED BY 18 MEV PROTONS INCIDENT ON A FEW LIGHT NUCLEI

(L. C. Card No. Mic 58-7818)

Edgar Francis Bennett, Ph.D.
Princeton University, 1958

Using a thin proportional counter as a velocity selector in conjunction with a sodium iodide crystal to measure energy, deuterons from proton induced reactions in some light nuclei were studied. The detection system was capable of presenting an essentially undistorted spectrum of deuterons in the presence of a background of protons of the same energy and considerably more intense.

Angular distributions of deuterons from C^{13}(p,d) C^{12}; N^{14} (p,d) N^{13}; N^{15} (p,d) N^{14}; F^{19} (p,d) F^{18}; Na^{23} (p,d) Na^{22}; (p,d) Mg^{24}; and P^{30} were taken. Butler curves were calculated to fit the experimental distributions and reduced level widths extracted. Level widths (or more specifically ratios of level widths) were computed using shell model wave functions where sufficient information on the nuclear states involved was available, and these were checked against experiment. Generally fair agreement was found in F^{18}, one at 1.7 Mev. (1^+) and the other at 4.1 Mev. (1^+, 2^+, 3^+). A state in P [illegible] at about .8 Mev. was also found having a spin of 0^+ or 1^+.

Microfilm $2.00; Xerox $5.60. 111 pages.

ELECTRON SPIN RESONANCE IN ALUMINUM

(L. C. Card No. Mic 59-6)

Richard E. Berry, Ph.D.
Princeton University, 1958

Electron spin resonance absorption in metals has been characterized by one outstanding fact. Ever since the effect was discovered by Griswold, Kip and Kittel, only sodium and lithium have had a pronounced spin resonance absorption over a wide temperature range. Electron spin resonance absorption has not been observed in the common conductors gold, silver and copper. This experiment describes the data observed from oxide coated, 300A^0 diameter aluminum spheres at room temperature in a 1,285mc./sec. system. The interest in this experiment results from the observation that as the band structure becomes complicated, the resonance experiment becomes more difficult. Aluminum is a light element as are lithium and sodium, and aluminum has 2 s and 1 p electrons in its conduction band in contrast to simply 1 s electron for the alkali metals. Since 2 s electrons can only give a conductor by interaction with the p band or by semiconductor extrinsic conduction, aluminum appears to be the most likely next step beyond the alkali metals.

This electron spin resonance absorption experiment found a superposition of a 1,2000 gauss (full width at half maximum absorption) line and 80 to 120 gauss (full width at half maximum absorption) line. Because of the possibility of impurity resonance in the oxide film on the aluminum, it was necessary to check the magnitude of the susceptibility in order to identify the component due to conduction band electrons. The 1,200 gauss component required a susceptibility 25 times larger than the theory would allow for the contribution of the conduction band electrons. The 80 to 120 gauss line was about 1/3 to 1/2 of the prediction; this is agreement within the experimental error of the experiment. On this evidence, the component

of absorption due to conduction band electrons would be the 80 to 120 gauss line. In the course of study of the impurities in various samples of aluminum, it was discovered that the 80 to 120 gauss component was attenuated by the presence of impurities in concentrations greater than $1:10^4$. Because the attenuation would have to be conduction electron diffusion limited to give the observed effect, this data also supports the identification of the 80 to 120 gauss component as that due to conduction band electrons.

In addition to the data on aluminum, two other areas of general interest are discussed. First the design and construction of a frequency stabilized, high sensitivity impedance bridge at 1,285 mc./sec. is described. Many of the components of this system are novel, employing printed circuit waveguide, and metallized plastic resonant cavities. Secondly, the preparation of metal powders in the range of diameters from $100A^0$ to $800A^0$ by means of low pressure vacuum smokes is described. The technique has been applied to gold, aluminum, magnesium and lithium.

Microfilm $2.00; Xerox $6.20. 128 pages.

ULTRASONIC ATTENUATION BY ELECTRONS IN METALS AT LOW TEMPERATURES

(L. C. Card No. Mic 58-7636)

Henry Victor Bohm, Ph.D.
Brown University, 1958

Compressional and shear wave attenuation by electrons in various superconducting and normal metals at low temperatures has been measured as a function of frequency (10-110 Mc/sec), temperature (4.2^0K-1^0K), applied magnetic field (zero to 10 kilogauss), and sample purity.

In pure tin and indium samples where the mean free path of an electron can be made longer than the wavelength of sound, the compressional wave attenuation data lend experimental support to a recent theory of superconductivity by Bardeen, Cooper, and Schrieffer (BCS theory). In particular, satisfactory agreement is found with the theoretically predicted energy gap in the electron energy distribution of a metal in the superconducting state.

A tentative interpretation of preliminary shear wave data is also made. The experimental curve suggests that there are two mechanisms of fundamentally different character operative with shear waves, one of which apparently gives rise to an experimentally observed discontinuity in the attenuation at the transition temperature.

The attenuation due to phonon-electron interactions in normal metals is compared with theoretical expressions. From this comparison, one may infer that the mechanisms assumed by theory are essentially correct.

Results of experiments on the magnetic field dependence of the attenuation in normal metals indicate that this technique is a potentially powerful tool in studying Fermi energy surfaces in metals. In copper, an attenuation resonance phenomenon, which was found experimentally, is described in terms of a simple model relating the sound wavelength to the radius of the magnetically caused circular path of an electron. From calculations based on this model, the average electron momentum at the Fermi surface and the number of free electrons per atom are determined. For both copper and indium, a method of finding the mean free path of an electron in the metal is shown. Microfilm $2.00; Xerox $5.60. 115 pages.

A PULSE TECHNIQUE APPLIED TO ACOUSTICAL TESTING

(L. C. Card No. Mic 59-153)

Alfred Chih-Fang Cho, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Robert B. Watson

The lack of validity of the diffusion assumption makes it desirable to search for further means of assessing the acoustical properties of a room rather than a criterion based solely upon reverberation time. A pulse technique is devised to study transient sounds using an electro-acoustic system. The transmitting system includes an audio frequency oscillator whose output passes through a transmitter gate for a controllable length of time. This short package of pure tone is amplified and applied to a speaker to produce a short burst of sound. The duration of this burst (1.25 - 80 milliseconds) is governed by the transmitter gate control. The pulse generator determines the pulse repetition time (0.346 - 3.846 seconds) and synchronizes the operations of transmitter gate control, receiver delay, and horizontal sweep of the oscilloscope. Each pulse repetition time is adjusted to be greater than the reverberation time of the test room for the frequency chosen. The receiving system includes a microphone which picks up the sound at a suitable test position, amplifiers, control circuits, and an oscilloscope for final display of the received signal. The receiver control circuits include a receiver delay unit, a gate control unit, and a receiver gate. These circuits are synchronized with the transmitted pulse. The receiver gate and its control circuits allow selection of any portion (in time) of the received signal. Range of the receiver delay time is 1.22 to 140 milliseconds and range of the receiver gate length is 0.125 to 14 29 milliseconds.

The electro-acoustic system was used to perform three acoustical tests. In all these tests, a sound pulse was introduced into a room and the resulting sound field was measured with a microphone placed at some position in the room. Three transmitter pulse lengths of 1.85, 4.3, and 8.9 milliseconds were used for several audio frequencies ranging from 1 kc to 15 kc. All final data were recorded in pulse photographs.

The first test was evaluation of the transient response in a lecture room of 40,000 cubic feet volume. The speaker was placed on the lecture stand, and the microphone was placed at 20 positions representative of various sections of the room. Pulse photographs show the decay patterns of transient response and are judged by criteria based on tone quality, resonance, and good definition. It is found from the test that long-delayed echoes of considerable intensity occur in certain regions of the room. Such a study leads to the conclusion that the walls should be continuous rather than forming semi-enclosed spaces to avoid possible multiple reflections of sound pulses. The second test gave a measure of the absorption coefficient

of an interior wall. Pulse measurements were made at two locations, one before and one after the absorption of sound. The absorption coefficient was calculated from appropriate pulse heights. The third test was a trace of a sound path in a smaller room. The path was traced through several reflections from the walls. The microphone was placed in five positions in the sound path as determined by a ray diagram. The pulse heights observed from the five positions were converted to common reference intensity level. Such a test leads to the study of sound diffusion due to a single wave train in a room. The velocity of sound was also determined from the data.

A pulse statistical analysis was also made. Pulse photographs were extended to about half second sweep. A steady state decay curve was constructed using known values of T_{60}. The deviations from this steady state decay in transient pulse measurements (over the peaks and troughs) were measured for 35 terms. A "mean value" decay curve was constructed from the average of the deviations. From the transient curve and the "mean value" curve, a rms deviation was obtained. The rms deviations for several positions in a lecture room and at different frequencies were computed.

The pulse measurements are a beginning effort to develop a technique for assessing the quality of sound within a room in terms of the transient response of the room.

Microfilm $2.00; Xerox $5.80. 118 pages.

THE FINE STRUCTURE OF THE X-RAY ABSORPTION EDGE OF CUBIC FERRITES

(L. C. Card No. Mic 59-154)

James Edward Dowdey, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Harold P. Hanson

The cubic ferrites are compounds with the "spinel" structure and the general chemical formula MFe_2O_4 where M represents an element of the first transition series. Because of the interesting chemical and physical properties of the ferrites, a series of x-ray K absorption edge measurements were made on these materials. As part of the ferrite measurement program, studies were made on the oxides because the ferrites are formed from the heat treatment of Fe_2O_3 and the oxide of M. Further, the corresponding sulfide of M was investigated. The study of the K absorption edges was designed to produce information concerning the perturbation of electronic energy levels.

Basically, the absorption coefficient of a material for x-rays is measured by obtaining the intensity of the beam before it enters the material and after it has traversed a given thickness. These two intensities were measured by two detectors in a tandem arrangement with a sample between them. Several methods of detection were investigated which included Geiger counters, proportional counters, scintillation counters, and gas flow counters at atmospheric and reduced pressures. The optimum thickness and apportionment of counts were considered on the basis of statistical fluctuation. A high resolution double crystal spectrometer was used and the data was recorded on two scalers.

The fine structure of the absorption edges in the materials were interpreted as a composite of electron transitions from the 1s state to the 3d, 4s, 4p, and np ($n \geqslant 5$) levels. Hybridization of the orbitals gave some p character to the 3d and 4s bands so that the 3d and 4s transitions are not in violation of the atomic selection rules and maintain the dipole nature. It was suggested that some of the high energy absorption might be due to transitions to states associated with atoms other than that from which the K electron was ejected.

The curve for the zinc edge of the ferrite could not be interpreted on this basis. It was suggested that the peculiar shape of this curve might be due to splitting of the zinc 4p state by the magnetic field produced by the triply ionized iron atoms. Microfilm $2.00; Xerox $5.00. 99 pages.

DECAY OF BOUND MUONS IN IRON AND COPPER

(L. C. Card No. Mic 59-1083)

Fred Edward Holmstrom, Ph.D.
University of Utah, 1959

Chairman: J. W. Keuffel

The spontaneous decay rate $\lambda_d(Z)$ was measured for muons stopping in heavy elements using an improved cosmic ray counter with 2 ft. by 2 ft. scintillators and a large acceptance solid angle. A water filled Cerenkov velocity selector was tightly sandwiched between two thin scintillators to ensure positive identification of stopping events.

A muon stopping in the target actuated a 10 Mc ringing circuit, and the ensuing oscillations were counted by a high speed scaler until the decay event occurred. The time delay was obtained in terms of the number of oscillations counted.

The composite time distribution of decay electrons from cosmic-ray muons was measured in aluminum, iron, and copper. Aluminum was used to eliminate the need to determine absolute efficiencies assuming the decay rate $\lambda_d(13) = \lambda_o$ = rate for free muon decay. The anomaly at Z = 26 suggested by previous work was confirmed, and a value of $\lambda_d(26)/\lambda_o = 1.19 \pm 0.10$ was obtained. A similar measurement at Z = 29 gave $\lambda_d(29)/\lambda_o = 0.98 \pm 0.12$.

Since existing measured disappearance rates $\lambda(Z)$ for copper disagree with each other and theory, a decay curve of capture radiation was measured to give a mean life of 163 ± 6 mμsec based on runs totalling 201 hr. A similar measurement gave 201 ± 12 mμsec for iron. Combination of these mean lives with the electron counting results of Weinrich and Lederman gives $\lambda_d(26)/\lambda_o = 1.15 \pm 0.06$ and $\lambda_d(29)/\lambda_o = 0.90 \pm 0.08$.

Microfilm $2.00; Xerox $4.80. 93 pages.

A QUANTUM-MECHANICAL THEORY OF THE CONTRIBUTION OF EXCITONS TO THE COMPLEX DIELECTRIC CONSTANT OF CRYSTALS

(L. C. Card No. Mic 59-126)

John Joseph Hopfield, Ph.D.
Cornell University, 1958

By using a formalism in which excitons are represented by boson operators (in close analogy to spin waves), the exciton-photon interaction problem is solved without the use of perturbation theory. It is shown that the description of absorption in terms of the annihilation of a quantum of radiation with a resulting electronic transition to an exciton state is not correct. The "optical lifetime" of an exciton state for single photon decay is also not a valid concept. The wave-number conservation rule results in the absence of ordinary transitions for these processes because there is no "density of final states" coupled to the initial states.

The correct description of the exciton-photon interaction is in terms of states which are mixtures of photons and excitons. There are two energies of mixed exciton and photon modes for every real wave-vector if one exciton band is considered. The exciton-photon interaction problem is shown to be the quantum-mechanical equivalent to a classical dispersive dielectric without damping, if the effects of the finite effective mass of the excitons are neglected. The dielectric constant is computed from the relation between energy and wave-number for the mixed states.

Optical absorption occurs only when phonon interactions are introduced into the crystal Hamiltonian. Phonon-induced transitions between the mixed states can be represented by complex energies for states of real wave-number. The resulting relation can be inverted to yield complex wave-number as a function of real frequency. This inversion yields, to first approximation, the expression for the complex dielectric constant of a classical dispersive dielectric with damping. "Local field" effects are treated implicitly in the exciton wave functions and do not need to be explicitly added to the electrodynamics.

This method of computing the absorption coefficient is valid even though the absorption length is smaller than a wavelength. The theory enables one to compute oscillator strengths of exciton absorption lines from the experimental optical parameters. A general discussion of optical absorption experiments is given. The theory is applied to compute oscillator strengths in the fundamental absorption band for NaCl from experimental data.

The division of the crystal into sub-blocks, the use of semi-classical radiation theory, the use of a group velocity, and the assumption that the imaginary part of the dielectric constant is small are all avoided. The theory is valid for wavelengths much greater than the size of a crystal unit cell (umklapp processes are neglected). Only optically isotropic crystals are considered. The most important general result of the theory is a better understanding of the nature of the optical absorption process for exciton states.

Microfilm $2.00; Xerox $6.40. 131 pages.

DISPERSION RELATIONS FOR POTENTIAL SCATTERING

(L. C. Card No. Mic 58-7853)

Nicola Najib Khuri, Ph.D.
Princeton University, 1957

Dispersion relations of the type discussed for relativistic field theories are shown to hold for the scattering of a particle from a potential. In contrast to the field theoretic case, the derivation here makes no use of the concept of causality but is instead directly based on the analytic properties of the Fredholm solution of the scattering integral equation. Both the cases of non-relativistic Schrödinger particles and relativistic Dirac particles are considered.

Under certain explicit assumptions about the potentials, it is shown that the scattering matrix element, considered as a function of the energy and the momentum transfer, can be extended to a function analytic in the complex energy plane, for real fixed momentum transfer. The use of the Fredholm theory enables one to deal with the bound states easily. One finds that they always lead to zeros in the Fredholm denominator and consequently to poles in the scattering matrix. Unlike the field theoretic case, the asymptotic behavior of the scattering amplitudes on the large circle in the complex energy plane can here be determined without any ambiguity. The Schrödinger scattering matrix element will asymptotically approach the Born approximation, while the Dirac matrix element when divided by one power of energy will approach zero.

The dispersion relations then follow in the standard way from the Cauchy integral formula. In order to avoid integrations over negative energy in the Dirac case, one has to define the charge conjugate scattering matrix and derive the dispersion relations for linear combinations of the particle and antiparticle amplitudes.

It is also shown that the partial wave expansion for the scattering amplitude converges in the unphysical region and thus provides a way of determining the amplitude in that region. The treatment of Klein-Gordon particles is sketched and shown to be identical with the Dirac case.

The role of causality in our proofs is briefly discussed, and the difficulties connected with non-local potentials are pointed out. Microfilm $2.00; Xerox $5.00. 99 pages.

A CLOUD CHAMBER INVESTIGATION OF CHARGED CURIOUS PARTICLES

(L. C. Card No. Mic 58-7859)

George K. Lindeberg, Ph.D.
Princeton University, 1957

Results from a study of charged curious particles in cosmic rays are presented. These were obtained using, at an altitude of 10,600 feet, one cloud chamber in a magnetic field of about 5700 gauss and another with 11 tungsten plates representing about 230 gm/cm^2 of Cu equiv. arranged such as to permit mass determination from momentum and range measurement. Quantitative ionization measurements by the method of droplet counting were possible in the magnetic field chamber for about 33,000 pictures of the total of about 45,000.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The results obtained fall into three classes.

1) Direct mass determinations from ionization and momentum measurements on 35 events selected during the scanning as possible K mesons, including 23 positive and 6 negative undecayed events, were made and the weighted average was found to be $948 \pm 16_{int} \pm 19_{ext}\ m_e$. The errors are standard deviations. There were found in addition 3 undecayed particles of indeterminate sign whose masses appeared to be intermediate between those of the π and K mesons. The average mass of these was $565 \pm 25_{int} \pm 29_{ext}\ m_e$. It was observed that this finding was similar to that of Alikhaniyan et al. (1956). Finally, there were found 2 negative undecayed particles, 1 of mass $2650 \pm 260\ m_e$, and the other of mass $1330\ 115\ m_e$. The former mass value is in agreement with that of the Ξ^- hyperon, and the event was identified as such upon consideration of the fact that its long observed flight time was inconsistent with the known short mean lifetime of the Σ^- hyperon. It was noted for the latter event that agreement with the K meson mass was possible, but that similar masses have been obtained in other experiments.

2) Mean lifetime measurements made with the use of the independently identified maximum likelihood method of Bartlett (1953) gave for the K^+ mesons a value of $.62^{+.31}_{-.18} \times 10^{-8}$ sec., for the K^- mesons a value of $1.4^{+1.6}_{-.6} \times 10^{-8}$ sec., and for the Ξ^- hyperons a value of $2.4^{+8.4}_{-1.5} \times 10^{-9}$ sec. Most of the information in this latter result came from the one event in which the Ξ^- did not decay. Use of the decay identified maximum likelihood method for a mean lifetime determination on a sample of 9 events selected so as to be as free as possible of K^- meson and Ξ^- hyperon contamination yielded the result $2.2^{+1.8}_{-.7} \times 10^{-10}$ sec. in agreement with the best value for the Σ^- hyperon mean lifetime. The K^+ and K^- results are also in agreement with current best values as determined in accelerator experiments. The Ξ^- value is in agreement with the best cosmic ray value. The lower 95% confidence limit is about $.4 \times 10^{-9}$ sec. No evidence was found for K meson mean lifetimes of about 5×10^{-10} sec.; the addition of the decayed K^+ events of the data to that of the previous experiment of Arnold (1955) which had indicated a short mean lifetime for the positives eliminated the effect.

3) A study of 27 decayed K^+ mesons indicated that no significant departure from the best values for the branching ratios were evidenced.

Microfilm $2.00; Xerox $7.00. 146 pages.

GAMMA-GAMMA ANGULAR CORRELATION IN Cd^{110}

(L. C. Card No. Mic 58-7863)

John W. McClain, Ph.D.
Princeton University, 1957

By the use of an apparatus consisting of one fixed and one movable scintillation detector, the directional correlations were measured of three gamma-ray cascades in Cd^{110}, a daughter by negatron decay of Ag^{110}.

The effective angular resolution of the detectors was determined by measuring the directional correlation of annihilation radiation from a Na^{22} "point source" and by sweeping each detector across a narrow collimated pencil of gamma-rays from Co^{60}; the results were then used to make the geometrical corrections to the measured correlations in Cd^{110}.

The correlation measurements were insufficient to permit an unambiguous assignment of spin to the levels of Cd^{110}, but other information was available to supplement the experimental data.

From published data on the beta-transitions from the parent nuclide estimates were made of their comparative half-lives. These in turn enabled limits to be set on the spins of the terminal levels in Cd^{110}.

The resolving time of the coincidence circuit was known, making it possible to set an upper limit to the lifetime of some of the states of Cd^{110}. Data in the literature on the internal conversion of the Cd^{110} gamma-rays agreed with the lifetime information in requiring that most of the Cd^{110} gamma-rays have a multipolarity no greater than 2 and even parity. An immediate result is that all the main levels of Cd^{110} have the same parity. In particular they have the same parity as the ground state; viz., even.

When the above considerations were combined with the measured gamma-ray correlations, it was found that only three assignments of spin and parity to the main levels of Cd^{110} were permissible. Two of the assignments are nearly equally appealing, while the third is considerably less so.

The restriction of the gamma-rays of Cd^{110} to M 1, E 2, or an M 1 + E 2 mixture (the result of lifetime and internal conversion considerations) made it possible to set limits on the spins of a few other Cd states not involved in the correlation measurements.

The relative merits of the final three spin assignments are discussed in the light of nuclear systematics, shell model, and collective model.

Microfilm $2.00; Xerox $7.80. 170 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

GROWTH OF CADMIUM SULFIDE CRYSTALS BY CO-EVAPORATION OF CADMIUM AND SULFUR IN A VACUUM

(L. C. Card No. Mic 58-2306)

Ralph J. Miller, Ph.D.
Syracuse University, 1958

Supervisor: C. H. Bachman

Cadmium sulfide belongs to the group of crystals that are produced best by a vapor phase technique. In the case of cadmium sulfide, an inert gas is usually used as a carrier gas. The method used in this experiment is an extension of the vapor phase technique, the sulfur and cadmium being evaporated in a vacuum.

Cadmium sulfide crystals were grown by co-evaporation of cadmium and sulfur in a vacuum. Molecular beam ovens were used to produce beams of sulfur and cadmium which hit a heated substrate. The usual substrates were made of molybdenum and tantalum.

The sulfur furnace was operated at temperatures ranging from 115°C to 150°C. The cadmium furnace was run at temperatures from 350°C to 500°C.

Crystals and deposits were produced at temperatures of the substrate ranging from 122°C to 567°C for single thickness plates. Crystals and deposits grown on substrates above 450°C were analyzed by x-ray and found to be alpha or hexagonal type. These were polycrystalline and ranged in color from yellow to red.

At the lower temperature range of 120°C to 180°C the deposit was like solid CdS powder. From 180°C to 380°C the characteristic appearance was that of molten like masses. Spikes often grew from these masses. From 380°C to the temperature limit of 567°C, the needle and ribbon type crystals were most noticeable.

The crystals produced showed evidence of growth upon subsequent runs. With additional runs, they became more polycrystalline in appearance and much less like needles and ribbons. Often the over-growth started on the ribbons and needles on the first runs.

The deposits and crystals were generally photoconductive. Usually they were fluorescent under C.R. bombardment. Only the simplest tests were made for photoconductivity and fluorescence.

The crystals grown in this research have ranged up to 6 mm. in length. More were in the range of 2 to 4 mm. The needle and ribbon crystals grew best near the temperature limit of 567° ± 10°C for a single substrate. A plate upon which a temperature gradient was maintained and which was operated near the upper limit was most satisfactory for crystal growth.

Microfilm $2.00; Xerox $6.20. 128 pages.

THE INTERACTION OF A PROTON AND A HELIUM ATOM

(L. C. Card No. Mic 59-172)

Rufus Adolphus Moore, Ph.D.
The University of Texas, 1958

Supervisor: Dr. F. A. Matsen

A potential energy curve for HeH^+ has been computed using a 10-term wave function made up of Slater orbitals. The optimum orbital exponents have been found by the variation principle for a few points, and a graph of their variation with internuclear separation is presented.

A method of finding the optimum orbital exponent at any internuclear separation for one or two electron ionic structures is developed. It verifies that the Slater parameters are good approximations up to equilibrium separation except for hydrogen and helium. A generalization of Musulin's equation is proposed for models mixing exchange and ionic structures. A method for predicting the relative importance of the ground-state structures is presented.

Microfilm $2.00; Xerox $4.20. 80 pages.

X-RAY Cl K ABSORPTION SPECTRA OF THE ALKALI CHLORIDES

(L. C. Card No. Mic 59-135)

James Oliver Porteus, Ph.D.
Cornell University, 1958

The chlorine K x-ray absorption spectrum of crystalline LiCl, RbCl, and CsCl have been precisely recorded, and the solid-state problem of interpretation discussed. A two-crystal vacuum spectrometer was used equipped with essentially perfect calcite crystals and with a proportional counter detection system. Absorber samples were prepared by evaporation technique in a system which permits the prepared sample to be introduced directly into the spectrometer without exposure to the atmosphere. The probable error in each value of absorption in the graph of μx vs photon energy does not exceed 0.01 and may be as low as 0.005 in regions of low μx. Values of μx in the various samples used range from 2.5 to 0.05. Optimum sample thickness is discussed. A new method of correction for the finite instrumental resolving power is developed with special consideration for the "tails" of the instrumental smearing function. The only requirement on this function is that it be essentially symmetrical. The errors in the corrected spectra are evaluated, however, only for an approximately Lorentzian function. The correction method involves finding an "optimum" solution for the convolution integral when the experimental data contain noise fluctuations. Features of the method have applicability in the general problem of instrumental smearing encountered in almost all phases of experimental science. Improvements are proposed with the hope of using the method soon to correct for the smearing effect due to the finite lifetime of the K state. The recent measurements of Hempstead on NaCl and KCl, carried out in this laboratory under very nearly the same experimental conditions as the present measurements, have also been corrected for all

instrumental effects as part of this Thesis. Detailed efforts have been made to achieve a high degree of accuracy, and reliable chlorine K absorption spectra for all of the alkali chlorides are now available for comparison and interpretation. Qualitative discussion of these spectra is given in terms of the various theoretical models that have been proposed to date. Particular emphasis is placed on x-ray excitation states. The similarities and differences in the experimental curves of the various alkali chlorides are pointed out. It is concluded that more sophisticated theoretical work is needed before a complete interpretation can be made.

Microfilm $2.05; Xerox $7.20. 155 pages.

DEUTERON STRIPPING ANGULAR CORRELATIONS

(L. C. Card No. Mic 59-177)

John Lewis Richter, Ph.D.
The University of Texas, 1958

Supervisor: E. V. Ivash

Angular correlation functions are derived for the deuteron stripping induced nuclear reactions of the types, X(d;p,γ)Y, X(d;n,γ)Y and the corresponding internal conversion processes, X(d;p,e)Y, and X(d;n,e)Y. It is assumed that Y^*, an excited level of Y, is formed by the (d,p) or (d,n) stripping process, and then promptly decays via a pure multipole electromagnetic de-excitation. The condition of promptness implies that the angular correlation function can be determined by the contraction of the two statistical matrices which describe the outgoing radiations. The stripping statistical matrix is based on the Tobocman theory of the (d,p) reaction.[1] The (d,n) statistical matrix is given as a modification of that of the (d,p). The statistical matrix for gamma emission is derived in a standard manner,[2] and the internal conversion statistical matrix is based on the theory of Rose, Biedenharn, and Arfken.[3]

Numerical calculations are included for the Mg^{24}(d;p,γ)Mg^{25} (Q = 1.70 Mev, E_d = 4.00 Mev) and the Be^9(d;p,γ)-Be^{10} (Q = 1.22 Mev, E_d = 3.90 Mev) reactions. The experimental work was done by Cox and Williamson.[4] The calculations show that the angular correlation function is not quite symmetric about the direction of the recoiling nucleus as predicted by the simple theory;[5] however, this effect is to be expected using a Coulomb corrected theory. Though the interpretation of the experimental data is essentially the same as that given by Cox and Williamson using the simple theory, the agreement between theory and experiment is somewhat improved. It is felt that the present theory would be of great value in interpreting angular correlation data for large Z nuclei.

Microfilm $2.00; Xerox $4.80. 91 pages.

1. W. Tobocman, Phys. Rev., 94, 1655 (1954).
2. L. C. Biedenharn and M. E. Rose, Rev. Mod. Phys., 25, 729, (1953).
3. M. E. Rose, L. C. Biedenharn, and G. B. Arfken, Phys. Rev., 85, 5 (1952).
4. S. A. Cox and R. M. Williamson, Phys. Rev., 105 1799 (1957).
5. S. T. Butler, Nuclear Stripping Reactions, John Wiley & Sons, New York, 1957, Chap. 8.

THEORY OF THE THERMAL BREAKAWAY OF A PINNED DISLOCATION LINE WITH APPLICATION TO DAMPING PHENOMENA

(L. C. Card No. Mic 58-7668)

Louis Joseph Teutonico, Ph.D.
Brown University, 1958

An investigation is made of the model of a pinned dislocation line under stress. The model used is that originally given by Koehler and later employed by Granato and Lücke in their theory of mechanical damping due to dislocations. By taking into account thermal fluctuations the probability of the thermal unpinning (breakaway) of such a dislocation line is calculated. The effect of this breakaway on the decrement and apparent modulus change felt by a stress wave traveling through a solid is also considered. The decrement is found to be both hysteretic and relaxational in nature: hysteretic, since the dislocation is irreversibly broken away from the pinning agents; relaxational, since the dislocation passes with a temperature-dependent mean frequency from one configuration of minimum energy through a saddle point configuration to another minimum configuration.

A comparison of this theory with the Granato-Lücke theory of mechanical damping (of which the present work is both an extension and a modification) reveals the following:

i) This theory contains the effect of temperature which the Granato-Lücke theory does not. The results of this theory reduce to those of Granato and Lücke when the temperature approaches zero.

ii) This theory appears to have the proper frequency dependence while the results of the Granato-Lücke theory are frequency independent.

iii) The dependence of the decrement on stress is slightly different in this theory from that in the Granato-Lücke theory but thus far experimental results do not determine which is more appropriate since both seem to fit the available data rather well.

Microfilm $2.00; Xerox $6.80. 143 pages.

THE THERMAL CONDUCTIVITY OF ALLOYS OF GERMANIUM WITH SILICON

(L. C. Card No. Mic 59-1007)

Arnold Martin Toxen, Ph.D.
Cornell University, 1958

The purpose of this experiment is to study the thermal resistivity produced by point defects. Thermal conductivity measurements were carried out over the temperature

range of 2°K. to 80°K. on five crystals whose compositions ranged from pure germanium to germanium +7.56 atomic% silicon. The conductivity measurements were made under steady state conditions, using two carbon resistance thermometers to measure the temperature gradients along the crystals.

The point defects in the crystals are the atoms of germanium and silicon, which because of their mass difference, scatter phonons.

The results of this experimental work are the following:

1. This experiment supports the conclusion derived by Klemens that the thermal resistivity caused by point defects varies linearly with temperature, at least for temperatures of $T/\theta = 0.26$ or below.

2. The direct proportionality of point defect resistivity upon Γ (See Equations VI-15 and VI-17) derived by Klemens seems to be incorrect.

3. The results of this experiment indicate that the point defect resistivity in the temperature range $0.075 < T/\theta < 0.26$ depends upon Γ in the following manner:

$$W_P = \frac{\pi^2 a^3 T}{0.90 u^2 h} 0.135 \Gamma^{0.68}.$$

4. From the above formula, W_P was calculated for germanium, silicon, and the isotopically enriched sample of germanium of T. H. Geballe. The results are:

$W_P = 20.6 \times 10^{-4}$ cm-°K./watt for germanium

12.1×10^{-4} cm-°K./watt for silicon

3.3×10^{-4} cm-°K./watt for germanium[74].

5. From the calculated values of W_P and the observed thermal conductivities of germanium, silicon, and germanium[74], the umklapp thermal resistivities of these substances were calculated. The latter were then compared with the theoretical formulae derived by Klemens (Equation VI-20b) and Leibfried and Schlomann (Equation VI-21). The agreement was poor which is to be expected since the vibrational spectra of these substances are quite complicated.[44, 43, 45]

6. A new source of phonon scattering has been detected in the silicon-germanium alloy crystals. This thermal resistivity is roughly proportional to T^{-1} at low temperatures. Of the known sources of phonon scattering, the one judged most likely to be the source of this resistivity is impurity band scattering.

Microfilm $2.00; Xerox $5.00. 100 pages.

THE USE OF FUNCTIONALS IN SCATTERING PROBLEMS

(L. C. Card No. Mic 58-7898)

Marcel Wellner, Ph.D.
Princeton University, 1958

The interaction of a quantized scalar meson field with a single fermion or boson is considered. The problem of calculating the scattering amplitudes is stated in terms of Feynman amplitudes. It is then reduced to finding the Feynman amplitudes for the no-meson system. The problem is then restated in a momentum space modified by the use of imaginary energies, so that the metric becomes Euclidean. This paves the way towards the final restatement of the problem in terms of functionals. To each set of no-meson Feynman amplitudes there corresponds a functional of a real function of a four-momentum, and conversely. The condition on the Feynman amplitudes becomes a functional equation for the functional. To solve it in the use of boson-boson scattering, an intermediate-coupling, cut-off independent, manifestly covariant approximation method is introduced which can be carried to arbitrary order. Microfilm $2.00; Xerox $4.80. 93 pages.

QUANTUM MECHANICAL IRREVERSIBLE GIBBSIAN ENSEMBLES

(L. C. Card No. Mic 58-2314)

Charles Richard Willis, Ph.D.
Syracuse University, 1958

Supervisor: Peter G. Bergmann

In this paper, we begin the extension of a model of irreversible processes of Lebowitz and Bergmann from the classical to the quantum mechanical domain. This model permits the construction of Gibbs-type ensemble for open systems not in equilibrium. The internal dynamics of the system that is engaged in a non-equilibrium process is assumed to be described fully by its Hamiltonian. Its interaction with its surroundings, i.e., the driving reservoirs, is described in terms of the weak, but sustained, interactions of perturbation theory. The reservoir consists of either free fermions or free bosons linearly or quadratically coupled to the system. The ensemble obeys an integral equation in configuration space, containing both the terms of the Liouville equation and a stochastic integral term that describes the interaction with the reservoir. We then show for a restricted but important class of interactions that equilibrium is approached monotonically. Microfilm $2.00; Xerox $3.00. 47 pages.

PHYSICS, ELECTRONICS AND ELECTRICITY

FREQUENCY MIXING IN MICROWAVE BEAM-TYPE DEVICES

(L. C. Card No. Mic 59-260)

Robert Woodman DeGrasse, Ph.D.
Stanford University, 1958

This report is primarily concerned with the frequency mixing effects which occur in microwave electron-beam type devices. The theoretical portion of the study is devoted to obtaining a better understanding of the nature of the nonlinear effects which can be introduced into or are already present in velocity-modulated electron beams.

Conversion of velocity modulation to current modulation

can be accomplished using velocity-sensitive deflection of the electron beam or by reflecting a portion of the electron beam from a retarding field region. These methods of producing current modulation have a nonlinear response which can be employed to obtain frequency conversion. A method of calculating the conversion efficiency of such devices is given.

A new velocity-sensitive deflection device is proposed which makes use of the transverse cyclotron resonance of an electron beam focused by a longitudinal magnetic field and is particularly suited for use in a linear-beam device such as a traveling-wave tube.

The use of a deflection scheme has the advantage that frequency mixing can be obtained down to very low intermediate frequencies. In the case of moderately high intermediate frequencies, good frequency mixing can be obtained directly from the nonlinear characteristic of a velocity-modulated electron beam.

A first-order nonlinear analysis of velocity-modulated electron beams is presented which includes the effects of space charge. An approximate value of the conversion gain with large local-oscillator signal is obtained from this analysis by using a value of local-oscillator beam current having the same order of magnitude as the d-c beam current.

The analysis is first used to calculate the conversion gain of klystron mixers, and the effects which limit the maximum conversion gain obtainable and the minimum useful intermediate frequency are considered.

The analysis is then applied to mixing in traveling-wave tubes employing forward-wave circuits. It is shown theoretically and experimentally that useful conversion gain can be obtained from microwave input frequencies to an intermediate frequency as low as 30 Mc by using a low-voltage drift region following the traveling-wave circuit. A conversion gain 4 db less than the small-signal gain of the traveling-wave circuit was obtained experimentally with a 3000 Mc input and a 30 Mc output by using this technique.

A two-helix mixer tube is analyzed which used the first helix for modulating the beam at the two input frequencies and the second helix for coupling out the intermediate frequency.

One double-helix mixer which was tested gave a conversion gain of 18 db from a 2.7 kMc input to a 1.2 kMc output with a bandwidth of 300 Mc. With the second helix resonated, this same tube gave a conversion gain of +30 db with a bandwidth of 20 Mc.

A second double-helix mixer gave frequency conversion from a 7.5 to 10 kMc input range to an intermediate frequency of 3 kMc with a bandwidth of about 1 kMc and a conversion gain of 22 db.

The conversion gain predicted by the first-order nonlinear analysis depends upon the ratio of local-oscillator beam current to d-c beam current which is assumed. The experimentally measured conversion gains were compared with the conversion gains calculated from the theory. Ratios of local-oscillator to d-c beam current of 0.75 to 1.3 were obtained. It appears therefore that if the ratio is assumed equal to 1.0 that conversion gains could be predicted to within about ± 3 db.

Forward-wave mixers can also be operated as self-excited frequency mixers by introducing feedback in the first helix at the desired local-oscillator frequency. This type of operation was demonstrated experimentally and the factors influencing such operation are discussed.

Stable high-output frequency division by a factor of two employing regenerative modulation was demonstrated using a double-helix mixer. The factors limiting bandwidth of the frequency division are discussed.

The factors which may influence the noise figure of traveling-wave mixers is discussed briefly.

Microfilm $2.50; Xerox $8.60. 189 pages.

AUTOMATIC X-RAY ABSORPTION MEASUREMENTS USING AN OSCILLATING-SAMPLE SYSTEM

(L. C. Card No. Mic 59-156)

William Edward Flynt, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Harold P. Hanson

X-ray absorption spectroscopy has been used for obtaining information about the electronic energy levels in solids and for investigating the mechanism of chemical bonding. The technique involves high resolution measurements of the fine structure of X-ray absorption edges. Significant drawbacks to the method have been the difficulty of obtaining reliable data and the tediousness of data taking and data reduction.

An instrumentation system has been developed which, when used in conjunction with a double-crystal X-ray spectrometer and Geiger counter, provides an automatic measurement of the X-ray absorption coefficient of a thin sample and presents the reduced data in graphical form. An oscillating-sample system is used to provide a quasi-simultaneous measurement of I_0 and I (the incident and transmitted intensities, respectively), which appear in the absorption equation $I = I_0 e^{-ux}$. The quantity $\log I/I_0$ is computed by electronic analog means, thus yielding -ux, which is plotted as a function of wavelength on a paper chart recorder. The division of I by I_0 eliminates many of the beam intensity instability problems associated with measurements of this kind.

A servo driven wedge absorber is incorporated which will not allow the intensities to exceed the operating capabilities of the system, in the event that a characteristic line of the target material is encountered. Actually the presence of such a line is somewhat of an advantage, since use can be made of the higher intensity available, and it provides a convenient wavelength reference.

This measurement system has been used to examine with high resolution the absorption fine structure which extends to several hundred volts on the short wavelength side of the K-edges of nickel and zinc in various states of chemical combination.

Microfilm $2.00; Xerox $4.40. 81 pages.

PHYSICS, METEOROLOGY

EFFECTS OF FOREIGN GASES ON THE TOTAL ABSORPTION OF ENTIRE BANDS IN THE INFRARED

(L. C. Card No. Mic 59-424)

Edgar Bryson Singleton, Ph.D.
The Ohio State University, 1958

The total absorption of an entire band in the infrared is defined as the area under the curve of fractional absorption at a given frequency plotted versus frequency. It can be shown that the total absorption, $\int A(\nu)d\nu$, is independent of the effective slit width of the spectrometer and depends only on the physical properties of the absorbing molecules. Previous workers have shown that the total absorption is a function of the number of absorbing molecules present in the path of the radiation beam, the partial pressure of the absorbing gas, the partial pressure of any non-absorbing or "foreign" gas in mixture with the absorbing gas and the absolute temperature.

In the present work additional data are presented in tabular form to augment existing data by extending the range of variation of certain selected parameters. In particular, the effects of different non-absorbing gases on total absorption have been studied. The total absorption has been determined for the N_2O bands at 4.5, 7.78 and 8.57 microns, the 4.7 micron CO band, the 4.2 micron CO_2 band, the 3.36 micron C_2H_6 band and the 3.3 micron CH_4 band at absorber concentrations from 0.075 to 1.5 atmos cm and total pressure of absorber plus non-absorber from 10 to more than 3000 mm Hg. The temperature was held constant. In the study, He, H_2, N_2, O_2, CO, CO_2, CH_4, and A were used as non-absorbing gases, which are said to "broaden" the individual rotational lines of the spectrum, thus increasing the observed total absorption of the entire band. Curves of total absorption versus total pressure are presented to show the effect of these foreign gases on the total absorption. The observed data can be satisfactorily represented by two types of empirical relations. In certain regions the curve of total absorption versus total pressure can be represented in an exponential form as

$$\int A(\nu)d\nu = kP^m,$$

where P is the total pressure and k and m are determined from the curves. In all regions in which the exponential form could not be fitted, a simple logarithmic series was used:

$$A(\nu)d\nu = c_0 + c_1 \log P + c_2(\log P)^2 + c_3(\log P)^3,$$

where $c_0, \ldots, c_3$ are determined from the curves. Values of the constants are given for each region in which the empirical relations were fitted, and values of total absorption calculated from the empirical relations are given in tables along with observed total absorption.

The ratio of effective molecular collision diameters may be obtained for the molecules involved from each curve of total absorption versus total pressure. These ratios have been calculated and are listed together with similar ratios determined by other workers and other methods in infrared spectroscopy and atomic spectroscopy.

Microfilm $2.00; Xerox $5.60. 112 pages.

PHYSICS, NUCLEAR

MEASUREMENT OF THE SPIN OF ARSENIC^{76} BY THE ATOMIC BEAM METHOD

(L. C. Card No. Mic 58-7830)

Robert L. Christensen, Ph.D.
Princeton University, 1957

The Princeton focusing atomic beam machine has been used to measure the spin of the odd-odd nucleus As^{76} with the result that I = 2. The technique was that of magnetic resonance in the atomic hyperfine structure.

The major problem to be overcome in this work was the production of a beam of arsenic atoms. This beam was formed by dissociating molecular arsenic vapor in a magnetron-powered microwave discharge. A six-pole permanent focusing magnet was used in a form of Stern-Gerlach experiment to determine that the discharge was producing about 25% dissociation. The discharge seemed not to operate in a steady manner over the length of time required for taking the data of a resonance. Therefore a method of taking data was devised which averaged the beam fluctuations over a number of points. Due to the geometry of the apparatus, this necessitated observing the resonances in a flop-out manner.

Resonances were observed in three different values of static magnetic field. The measured frequencies are consistent only with $\Delta F = 0$ transitions within the states $J = 3/2, I = 2, F = 7/2$ and $J = 3/2, I = 2, F = 5/2$. At the highest field used, a splitting of the resonance was observed. This is attributed to multiple quantum transitions within the $F = 7/2$ state. The spin of 27-hour As^{76} is thus determined as two.

Microfilm $2.00; Xerox $7.00. 149 pages.

NUCLEAR MAGNETIC RESONANCE SPECTRA OF SOME AMINO ACIDS

(L. C. Card No. Mic 59-374)

Leland Dwight Farringer, Ph.D.
The Ohio State University, 1958

Nuclear magnetic resonance spectroscopy offers a method of studying molecular structure through measurement of local magnetic fields at the nuclear sites. Differences in the electronic diamagnetic shielding effect at non-equivalent sites of identical nuclei can be detected and measured. Interactions between the nuclei of non-equivalent chemical groups within a molecule can give additional information.

Experimental aspects of the application of nuclear magnetic resonance spectroscopy to the study of amino acids are discussed. The choice of solvent and spectral referencing methods are found to have significant influence on the measurements. Observation of line splittings in the spectra require, in some cases, instrumental resolving power of the order of 10^8. A spectrometer with this resolving power, operating at 40 Mc./s., was employed in the experimental work which is described.

Measurements of proton resonance spectra of glycine, alanine, cysteine, arginine, lysine, asparagine, phenylalanine,

serine, methionine, leucine, and isoleucine dissolved in D_2O and in anhydrous H_2SO_4 are reported. Correlation of the observed spectral data with known molecular structures of the sample materials is discussed. Indications of rapid proton exchange between hydrogen sites of the solvent and of certain chemical groups in the solutes are described. In particular, a strong influence of the solvent on the NH_3 resonance of all the D_2O solutions studied is attributed to such an exchange process.

Microfilm $2.00; Xerox $6.40. 135 pages.

PC CONSERVATION IN STRONG INTERACTIONS AND WIDE ANGLE PAIR PRODUCTION AND QUANTUM ELECTRODYNAMICS AT SMALL DISTANCES

(L. C. Card No. Mic 59-266)

Steven Clark Frautschi, Ph.D.
Stanford University, 1958

The consequences of combined PC conservation (P = parity, C = charge conjugation) as an absolute selection rule are discussed.[1] Separate conservation of P and C is ensured by gauge invariance in electrodynamics, and by charge independence together with hermiticity in renormalizable pion physics. No known principle inhibits P violation in K interactions, and some experimental consequences of such violation are investigated, especially for the reaction

$$\pi^- + P \rightarrow \Lambda + K^0 \ ;$$
$$\Lambda \rightarrow P' + \pi^{-\prime} \ .$$

Arguments are given suggesting that P violation in K interactions is consistent with the observed degree of P conservation in nuclear wave functions.

Previous experimental evidence on quantum electrodynamics (QED) at small distances[2] indicates that electron propagators are correctly predicted by QED for $r \gtrsim 2 \times 10^{-13}$ cm. Observation of wide angle pair production in hydrogen provides a means of testing electron propagators to $r \sim 3 \times 10^{-14}$ cm., by forcing intermediate electron states far off the energy shell. Two experimental situations have been found in which the effects of nucleon structure can be well represented by charge and moment form factors from electron-proton scattering, so that the experiments provide an unambiguous test of QED at small distances:

(1) Positrons of 70 to 100 Mev are observed at right angles to incident photons of up to 140 Mev. The photon energy is bounded by the π^0 threshold.

(2) Electrons and positrons produced by photons with 500 Mev or more are observed in coincidence, at equal energies and angles. Complete covariant calculations of these cross sections, with radiative corrections, have been performed.

In an appendix a complete expression for infrared radiation, including all orders of virtual and real photon contributions in the limit of zero energy resolution, is obtained.[3] Microfilm $2.00; Xerox $4.40. 82 pages.

1. Drell, Frautschi, and Lockett, to be published by 1958 Cern Conference. See this article for other references.

2. See Bjorken, Drell, and Frautschi, to be published in Phys. Rev., for details and references.

3. This work is an extension of Yennie and Suura, Phys. Rev. 105 1378 (1957) which contains a complete treatment of real photons.

THREE APPLICATIONS OF THE DERIVATIVE MATRIX FORMALISM

(L. C. Card No. Mic 58-7856)

Robert Krotkov, Ph.D.
Princeton University, 1958

The consequences of charge independence for nuclear reactions are examined in Chapter 1. Although isotopic spin is conserved when the the interacting nuclei are close together (which is expressed mathematically by saying that the R matrix commutes with the three isotopic spin operators), differences between the Coulomb and free particle wave functions (describing the interacting nuclei when they are far apart) can lead to non-conservation of isotopic spin at energies comparable with the height of the Coulomb barrier. Some numerical examples are given to show that the scattering matrix does not conserve isotopic spin, and the displacements between the first three corresponding levels in the mirror nuclei C^{13}, N^{13} reexamined. (The level shifts were first considered from this point of view by Ehrman[45] and Thomas[46]). The implications of isotopic spin conservation for the interactions of nucleons with the mirror pair (B^{11},C^{11}) are worked out.

In Chapter 2, the R matrix formalism is used to describe the low energy total cross section for neutrons incident on Mn^{55}. When the interference between levels of the same spin and parity is taken into account, it is found that the experimental curve can be fitted very satisfactorily, except for a discrepancy with the measured value of the coherent scattering cross section. The experimental data is not good enough that one can be sure whether the discrepancy is real or not.

Matrix elements for the Hamiltonian of Ca^{40} are calculated in Chapter 3. The nucleon-nucleon interaction is approximated by a Serber force with a gaussian well; the matrix elements are between determinantal wave functions made up of harmonic oscillator eigenfunctions. The object of the calculation is to

1) estimate (using perturbation theory) how well a single determinant can represent the true Ca^{40} wave function

2) obtain the second moment of the strength function which is used to describe the average total cross section for the scattering of neutrons from Ca^{40}.

3) find how the Hamiltonian matrix computed with the forces and wave functions mentioned above compares with the idealized Hamiltonian assumed in reference [50], and obtain a value for the parameter $q = v^2/N$ introduced in that reference.

The results are as follows:

1) the admixture of other determinants in the nuclear wave function is about 40%

2) the second moment of the strength function is (60 Mev)^2, which is much larger than either the value obtained by Lane, Thomas and Wigner[30] ((22 Mev)^2), or the square of the width of the strength function associated with the Cloudy Crystal Ball model ((1½ Mev)^2).

3) v^2/N turns out to be 0.12. In the model of reference[50], this corresponds to a resonance shape for the strength function. The half width of this strength function is 40 Mev, and its second moment is $(50\ \text{Mev})^2$.

Microfilm $2.00; Xerox $7.00. 149 pages.

INELASTIC SCATTERING OF 6.2 MEV PROTONS BY MAGNESIUM

(L. C. Card No. Mic 59-392)

Henry Allyn Lackner, Ph.D.
The Ohio State University, 1958

Direct reactions have been observed in many inelastic scattering processes at high energies (greater than 15 Mev). At these energies, it is to be expected that the compound nucleus formed in the reaction will not decay to the low lying states of the residual nucleus and, therefore, there will be no competition between direct reactions and compound nucleus reactions. It is of interest to inquire to what extent direct reactions occur when such competition exists. In an attempt to partially answer this question, observations of the angular distributions of protons from the reaction Mg^{24} (p,p') Mg^{24} (1.37 Mev) were made at four energies around 6.2 Mev. These distributions were found to be asymmetric about 90 degrees, and varied quickly with change in bombarding energy. Angular correlations of the photons emitted from the excited state and of the protons leaving the nucleus in that state were observed. These data were fitted fairly well by a constant term plus a term $\sin^2(2\theta)$, which is characteristic of direct reactions. These experiments indicate that at these energies the direct reaction is in strong competition with the compound nucleus reaction, and interference between these two processes is responsible for the variation of the angular distributions as well as their asymmetry.

Microfilm $2.00; Xerox $4.00. 73 pages.

STUDIES IN NUCLEAR ISOMERISM

(L. C. Card No. Mic 59-652)

Ivar Emanuel Lindstrom, Jr., Ph.D.
University of Oregon, 1959

Adviser: Bernd Crasemann

As late as 1951, no nuclear isomeric states with lifetimes of the order of a millisecond were known, while numerous longer- and shorter-lived isomers had been found. Recently, experimental techniques have been developed which led to the discovery of several isomers in the millisecond range (from 10 μsec to 10 msec). The experimental difficulties in this field are considerable, and there has been a definite need for better and more reliable instrumentation. In the present thesis, the development of delayed-coincidence apparatus is described which fills this need. Through use of components and circuits not heretofore employed for this purpose, a relatively simple and inexpensive device has been constructed which permits the highly accurate determination of isomeric lifetimes of the order of milliseconds. The statistical theory of delayed-coincidence counting has been worked out and applied to the interpretation of data obtained with the new instrument. The apparatus has been tested by re-determining the half-life of the isomeric state of Ta^{181}, which occurs in the beta decay of Hf^{181}. The result for this isomer is 17.83 ± 0.10 μsec. The half-life of the isomeric state of Y^{88}, fed by electron capture from Zr^{88}, has been measured. The result is 300.5 ± 5.0 μsec. The radioactive zirconium was prepared by alpha-bombardment of strontium in the Crocker Laboratory cyclotron of the University of California. By alpha-bombardment of gallium, a sample of As^{73} was produced, and the half-life of the first excited state of the daughter nucleus Ge^{73} was found to be 3.0 ± 0.6 μsec. An investigation of the decay of Ba^{133} has been continued. The existence of a 158-kev level in Cs^{133} has been confirmed by using a magnetic lens spectrograph to measure conversion electron spectra from a chemically purified barium source. A search for an isomeric state in Cs^{133} has been conducted with negative result. The decay scheme of Ba^{133} has been confirmed by fast and slow coincidence measurements.

Microfilm $2.00; Xerox $5.80. 118 pages.

THE DEVELOPMENT AND PERFORMANCE OF A NEW ELECTROSTATIC ACCELERATOR

(L. C. Card No. Mic 59-1158)

Irving Michael, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Raymond Herb

Both support column and accelerating tube are constructed of thin metal disks hard-soldered to ceramic rings and the entire vacuum system is of bakable construction. The tube is 5 feet long and is evacuated by an Evapor-ion pump. Without the tube the generator has been operated at potentials in excess of 7 Mv corresponding to gradients of over 1400 $\frac{kv}{ft}$. With flat-disk molybdenum electrodes in the accelerating tube usable voltage was limited to about 2.1 Mv. These electrodes were replaced with steel disks having side pump-out holes. Beam apertures are tapered from 1/4-inch diameter at the high voltage end to 1/2-inch diameter halfway down the tube and from there on the bore is uniform. For a short time the tube accelerated protons to an energy of 4 Mev corresponding to a gradient of 800 $\frac{kv}{ft}$ and no small discharges or electron loading were observed. A few ceramics were damaged during these tests and to prevent further damage to the insulators the spark gaps were shortened. Subsequently the tube sustained a voltage of 4.1 Mv without a beam but another insulator cracked and the tests were suspended. As it stands the tube should not be operated at voltages much above 3.5 Mv. Voltage division of the accelerator is accomplished by a series of negative point-to-plane corona gaps which are enclosed in a tube which is separate from the support column. The charging belt is equipped with paper staples which are charged by induction;

accelerator voltage is very stable. In view of the difficulties with insulator failure proposals are presented for the design of a new accelerating tube.

Microfilm $3.75; Xerox $12.60. 290 pages.

MULTIPLE PARTICLE EMISSION IN RESONANCE REACTIONS

(L. C. Card No. Mic 58-7885)

Andrej Sauer, Ph.D.
Princeton University, 1958

The dispersion theory of nuclear reactions has up to now been applied only to nuclear disintegrations in which the compound nucleus decayed with the emission of one particle. This theory is generalized to include multiple particle emissions.

The construction of the steady state wave function of the reacting system is performed in the conventional configuration space, which is divided into regions according to the nature of the interactions among the nuclear particles. The section of the wave function describing multiple particle decays can be assigned in a natural way to hitherto unutilized regions, in such a manner that the configuration space is now filled out completely. Then the R-matrix concept can be generalized: The value and the gradient of the wave function on the boundary of each region are interdependent, and it is possible to write down the derivative operator which relates them. By means of a similarity transformation, this operator can then be expressed in an especially simple form. In some of the regions, the interactions are partially known; this additional information is used to reduce the derivative operators by a process of elimination. Then the collision matrix of the reacting system can be determined.

The wave function in each region can be expressed formally as a superposition, with undetermined coefficients, of suitably selected eigen functions of the Schroedinger equation of that region; these regional functions are then matched smoothly to form the over-all wave function. The matching conditions along finite boundaries lead to systems of algebraic equations for the undetermined coefficients; if the boundaries extend to infinity, integral equations are obtained, the solutions of which permit the calculation of the energy distribution of the emitted particles. A formalism is devised which allows a rapid determination of the wave function.

All the partly generalized, partly novel concepts which are needed to describe multiple particle decays are developed during the investigation of a simple example, the (n, 2n) reaction with zero angular momentum; later, angular momenta are included. For these cases, the derivative operators are determined explicitly, and methods are discussed for the solution of the integral equations which occur in the matching process.

Microfilm $2.00; Xerox $4.20. 77 pages.

INELASTIC SCATTERING OF NEUTRONS FROM VANADIUM 51

(L. C. Card No. Mic 59-180)

Harold Dean Southward, Ph.D.
The University of Texas, 1958

Supervisor: Emmett L. Hudspeth

The cross section for the production of the first excited state of vanadium 51 was determined when this isotope was bombarded with Li(p,n) neutrons at energies between 367 and 932 Kev. The protons were accelerated with the University of Texas 4.0 Mev Van de Graaff accelerator.

The vanadium gamma ray converter was contained in a thin plexiglass ring having inner dimensions of 4" O.D. x 2" I.D. x 0.75" thick. The gamma ray spectrometer consisted of a 1" x 1" Harshaw NaI(Tl) crystal unit optically sealed to the face of a DuMont 6292 photomultiplier. The output of the photomultiplier was connected to a cathode-follower circuit which was connected to a linear amplifier. The output of the linear amplifier was connected to a 20 channel differential pulse height analyzer. A solid plexiglass ring was used to subtract out the pulses caused by neutrons which were scattered into the NaI crystal. The gamma ray yield was measured by determining the gamma ray counts in the photoelectric peak of the differential pulse height spectrum of the 320 Kev gamma ray. The neutron yield in the zero degree direction was determined with a BF_3 counter.

A standard Cr-51 source was mixed with vanadium 51 powder and poured into a hollow plexiglass ring similar to the one used in the scattering experiment. This radioactive ring was then centered around the NaI(Tl) crystal and the number of counts per unit time in the photoelectric peak of the 320 Kev gamma ray was determined. This data made it possible to calculate the product of the relative attenuation of the gamma ray by the ring and the NaI(Tl) crystal efficiency.

The efficiency of the BF_3 counter was determined with a standard radium-beryllium neutron source.

The maximum value of the cross section was 2.04 barns at a neutron energy of 825 Kev. Resonances were observed at 450, 600, 800 and 830 Kev and were probably due to resonance formation of the compound nucleus. Because of the spread in neutron energy, peaks which are separated by less than 25 Kev were not resolved.

The theoretical inelastic cross sections predicted by the complex potential theory were several times smaller than the corresponding experimental cross section. This indicated that the square well complex potential does not adequately describe the interaction of neutrons with the vanadium 51 nucleus. The theoretical calculations were carried out with the aid of the Hauser-Feshbach formula.

Microfilm $2.00; Xerox $3.60. 65 pages.

PHOTOSYNTHATE TRANSLOCATION

(L. C. Card No. Mic 59-1131)

Robert Stanley Gage, Ph.D.
Iowa State College, 1958

Supervisor: S. Aronoff

The following aspects were investigated in soybean, Glycine max seedlings using C^{14}, Cl^{36} and H^3 in 15-20 min. experiments. (1) The effects of removing growing points of stem and root and of steaming and severing stems at cotyledonary nodes was studied. No certain effect could be attributed to physical growth expansion. Steaming reduced the entrance rate into stems and cutting stopped movement in stems maintained in water. C^{14}-sugars were translocated from cut petioles at the same velocity but with about 10% of the rate (amount per unit time) of those photosynthetically incorporated into leaves. Some region below the epicotyl seemed to have directing influence for the whole plant. (2) Translocations were compared of chloride ion applied simultaneously with photosynthate. Comparisons were unsuccessful when HCl^{36} vapor and $C^{14}O_2$ were fed together to leaves, in the light due to the inhibition of photosynthesis by HCl. Restricted individual movement of Cl^{36} occurred from illuminated, starved leaves; unrestricted, from normal leaves in the dark. Relatively, greater amounts of Cl^{36} were moved to primary leaves there being evidence of an initial, small phase moving at about 7 m/hr. Simultaneous comparisons using C^{14}-fructose and HCl^{36} from a cut petiole, in one experiment, gave indications of the same mode of transport in the stem. (3) THO appeared in relatively minute amounts whether fed alone or with C^{14}-fructose to petioles. When a leaf was saturated with THO vapor in the dark (1 hr) prior to a light period, T-photosynthate was translocated in expected amounts but THO, only in minute amounts. On the basis of a calculated transpiration rate, it was concluded that the absence of THO could not be accounted for by dilution with xylem water. (4) Preliminary attempts at finding the precise translocation route by autoradiography, using T-photosynthate, in cucumber, Cucurbita sativus L. showed diffuse activity associated with phloem in longitudinal sections. Intense activity was found in newest sieve and companion cells with two adjacent bundles of one petiole crosssection. Results were inconclusive because dry-mounting techniques were unsuccessful. Light application of albumen adhesive was thought to result in some diffusion of tracer. Many sections were lost during processing. (5) Some theoretical justification, using the Horwitz model, was found for the existence of non-nodal activity peaks appearing midway down stems in all short-time experiments.

Microfilm $2.00; Xerox $6.00. 123 pages.

AUDITORY SENSITIVITY AND THE MAGNITUDE OF THE COCHLEAR POTENTIAL

(L. C. Card No. Mic 58-7865)

Thomas E. McGill, Ph.D.
Princeton University, 1958

At present, most auditory theorists accept as valid the electrical theory of auditory-nerve stimulation. The electrical theory may be stated quite simply. Under vibratory stimulation the hair cells of the cochlea produce a pulsating direct-current, called the "cochlear potential," which triggers the fibers of the auditory nerve.

The present study was concerned with relationships between auditory sensitivity and the magnitude of the cochlear potential. The study was designed to determine the magnitude of the cochlear potential at the threshold of hearing and its relation to frequency, to test the electrical theory of auditory-nerve stimulation through predictions from behavioral-sensitivity differences to the relative magnitudes of the cochlear potential, and to determine the relative importance of the transmission processes (defined as all factors preceeding and including the cochlear potential) and the neural processes (defined as all factors succeeding the cochlear potential) in the determination of sensitivity differences.

Audiograms were determined for a group of cats using 11 frequencies in the range of 100 cps to 10,000 cps. The animals were trained to cross a barrier for food at the sounding of a tone. Training was accomplished in a newly-devised training box which kept sound-pressure-level variations within fairly narrow limits. The intensity of the stimulus could thus be specified with little restriction of the animal's position. Following audiogram determinations, the ears of the animals were operated upon and cochlear potentials were recorded from the round windows.

The major findings were as follows:

1. Themagnitude of the cochlear potential for behavioral-threshold sound-pressure levels was determined and its relationship to frequency was presented and discussed.

2. Predictions from behavioral-sensitivity differences to differences in cochlear-potential magnitudes can be made with better than chance success. The following general relationships were determined:

a. A more sensitive animal generally produces a cochlear potential of greater magnitude for a given sound-pressure level than a less sensitive animal produces.

b. A more sensitive animal generally produces a cochlear potential of lesser magnitude for behavioral-threshold sound-pressure level than a less sensitive animal produces.

3. Sensitivity was found to vary both with differences in the transmission processes and with differences in the neural processes. In the particular sample analyzed the neural processes accounted for slightly more (55 per cent)

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

of the total of the sensitivity differences than did the transmission processes (45 per cent). The suggestion was made that the relative importance of the two processes may vary with age.

4. One animal exhibited very high behavioral thresholds. The operation disclosed infections of both ears and the resulting cochlear potentials were of low magnitude and unreliable.

5. The data supported the electrical theory of auditory-nerve stimulation.

Microfilm $2.00; Xerox $3.60. 62 pages.

STUDIES ON THE MECHANISM OF STIMULATION OF SECRETION OF GONADOTROPIC HORMONES USING A NEW, RAPID BIOASSAY

(L. C. Card No. Mic 58-7874)

Albert F. Parlow, Ph.D.
Princeton University, 1958

A new method of rapid biological assay for gonadotropic hormones and agents stimulating gonadotropin secretion has been devised based on the ability of these anterior pituitary hormones to rapidly deplete the ascorbic acid content of suitably prepared ovaries. Normal rats, 26-29 days old, were superovulated by injection with 50 International Units (I.U.) of unfractionated pregnant mare plasma (PMS), followed, in 56-65 hours, by 25 I.U. of human chorionic gonadotropin (HCG). Five to nine days later the right ovary was removed for ascorbic acid analysis and the material to be assayed injected intravenously by a tail vein. One hour after injection the left ovary was removed and its ascorbic acid determined. Reduction of ascorbic acid was expressed in percentage, as the difference between its concentration in the two ovaries, divided by the right ovarian concentration. Although surgery did not affect ovarian ascorbic acid it was reduced by luteinizing hormone (LH), in proportion to the amount injected, over the range 0.125 to 1.0 microgram. Maximal depletion of ascorbic acid was 40%. Follicle stimulating hormone was similarly active, as were the placental gonadotropins PMS and HCG. However, other anterior pituitary hormones, luteotropic hormone, somatotropic hormone, thyroidstimulating hormone and adrenocorticotropic hormone were ineffective. Luteinizing hormone elicited a response in hypophysectomized rats, indicating its action is directly on the ovary and is not mediated by the pituitary.

Since etherization, surgical trauma, and injection of Pitocin, morphine and histamine failed to effect ovarian ascorbic acid depletion in intact rats, it is concluded that these stimuli do not evoke endogenous gonadotropin secretion. On the other hand, these agents are all well known to be potent stressors, effective in stimulating adrenocorticotropic hormone secretion. Consequently, it is suggested that the mechanisms of stimulation of adrenocorticotropic hormone and gonadotropin secretion are separate and different.

Corroboration of the hypothesis of adrenergic involvement in the mechanisms mediating stimulation of gonadotropin secretion was obtained by the observation of the efficacy of epinephrine in evoking ascorbic acid depletion in intact, but not in hypophysectomized animals. An inhibition of the activity of epinephrine by Nembutal was demonstrated, indicating the action of epinephrine is probably not directly on the pituitary. Similar gonadotropin-stimulating activity is present in Pitressin and synthetic lysine-vasopressin.

It is pointed out that this technique is amenable to use in the clinic, especially in those problems where it is desired to know rapidly the level of gonadotropin excretion. Also, because of the high sensitivity of the techniques, it is possible to perform careful quantitative assays on urinary extracts, using large numbers of animals.

The failure of LTH, and the ability of LH, to deplete either ascorbic acid or cholesterol from these ovaries contradicts the view that LTH mobilizes these materials as precursors for progesterone secretion.

Microfilm $2.00; Xerox $3.00. 59 pages.

AN INVESTIGATION OF THE CONJUGATED PLASMA PROTEINS OF THE AMERICAN COCKROACH

(L. C. Card No. Mic 59-139)

Aristotle Nicholas Siakotos, Ph.D.
Cornell University, 1958

The conjugated plasma proteins of the American cockroach (Periplaneta americana L.) were characterized. A total of six fractions were found, four of which are present throughout the several instars studied. Two other fractions appear under various physiological conditions. The proteins were characterized on the basis of their composition, isoelectric properties, and relative mobilities. Included in this study are changes that occur during molting and blood coagulation, and differences between sexes.

The composition of these conjugated proteins indicates a possible transport function for triglycerides, phospholipides, sterols and carbohydrates. The protein of the neutral lipide containing fraction was found to be significantly higher in females. The molting process resulted in significant changes especially in the lipide distribution. Some evidence was presented that indicates that the recovery from a molt is markedly influenced by a lipoprotein clearing reaction as occurs in human plasma. The neutral lipide containing lipoproteins also appear to be involved in the blood clotting process. Further observations indicated that the blood cells may be contributing to the observed blood protein changes in this insect. The conjugated proteins were found to be in a dynamic state of balance, and their composition and concentration varied with the physiological state of the animal. The general properties of these proteins suggest similarities with the alpha and beta globulins of human blood.

Microfilm $2.00; Xerox $7.00. 147 pages.

POLITICAL SCIENCE, GENERAL

UKRAINIAN NATIONALISM AND SOVIET NATIONALITY POLICY AFTER WORLD WAR II

(L. C. Card No. Mic 58-7821)

Yaroslav Bilinsky, Ph.D.
Princeton University, 1958

The study aims to give a synthetic picture of the political forces that have been active in the Ukraine since 1945. It consists of three parts: a general introduction, a topical analysis of Soviet nationality policy, and a concluding chapter in which Ukrainian political attitudes are examined.

The three introductory chapters sketch the historical background of Ukrainian nationalism, provide a general survey of Soviet policy in the Ukraine after 1945, and present the major share of relevant socio-economic data needed in later analysis. Postwar nationality policy until Stalin's death is seen as part of the general Soviet policy of tightening ideological controls. The conscious reliance upon Russian nationalism, however, and the search for the slightest signs of Ukrainian "bourgeois nationalism" is also to be explained by Stalin's dissatisfaction with the considerable disloyalty of his Ukrainian subjects during the war. Stalin's successor Khrushchev recognized the pent-up pressures that had been accumulated since World War II: he has muted a little the harsh claim of Russian predominance in all walks of life, advanced local Party cadres, especially from the Ukraine, and allowed for a somewhat greater freedom of expression on the part of Ukrainian writers and scholars. The statistics show that although the Ukrainian people has made great progress in socio-economic advancement since 1926, it has not yet reached parity with the two largest national minorities in the Ukraine: the Russians and the Jews.

The topical chapters consider the acute but temporary problem of integrating Western Ukraine with the rest of the country; the long range policy of cultural Russification; the question of Ukrainian Party cadres, especially after 1953; and the international representation of the Republic. Major topics that have been covered in the chapters on Western Ukraine are the liquidation of the Uniate Church and the armed struggle with the Nationalist Underground. The chapters on cultural Russification examine to what extent the regime has furthered or hindered the use of the Ukrainian language and how it has interpreted Ukrainian literature (case study of the interpretation of Shevchenko) and Ukrainian history (the Kievan Rus and the Treaty of Pereyaslav, in particular).

The concluding chapter is based almost exclusively on questionnaire and interview data of the Harvard Project on the Soviet Social System, the Department of State, and my own interviews of wartime refugees and postwar defectors. Its main findings are: (1) In contrast to the 1917-1920 period, today virtually all Soviet Ukrainians identify themselves as Ukrainians. Educated peasants and workers of rural background do so aggressively. (2) All Soviet Ukrainians take pride in the economic achievements of the Republic. (3) Radical hostility against the Russians does not exist in the whole of the Ukraine, but points of friction develop in the course of career advancement. (4) The administrative elite adopt the Russian language; part of the cultural elite, however, who also receive some support from the regime, may nonetheless be committed to the Ukrainian national heritage.

My general inference from the interviews is that the problem of Ukrainian nationalism must be viewed in relation to the future of the regime. Should it maintain itself in full force over a long period of time or should it erode gradually, the Ukrainian elite will strive to strengthen their influence both in Moscow and in the Ukraine; should it be suddenly destroyed they will assume authority on the spot, even against the wishes of Moscow, to organize Ukrainian life as they see fit.

Microfilm $8.30; Xerox $28.40. 655 pages.

THE LEGISLATIVE PROCESS IN THE WEST GERMAN BUNDESTAG: THE CODETERMINATION LAW OF MAY, 1951

(L. C. Card No. Mic 59-263)

Jack Dudley Dowell, Ph.D.
Stanford University, 1958

This dissertation reviews and analyzes the legislative history of the law on codetermination in the iron, steel and coal industry, enacted by the Bundestag of the West German Federal Republic in April, 1951. It is a case study of the political process, of the struggle to incorporate the rights and duties of individuals and groups into formal legal rules. From the analysis of the struggle concerning codetermination certain generalizations are reached concerning the functioning of the Bundestag, its strengths and weaknesses, and its relations to the other departments of government and to the political parties.

Material for this dissertation was gathered during a systematic analysis of the official records of the Bundestag, articles and books on German government and codetermination, and the newspapers of the period. Interviews with representatives of the interest groups and political parties offered information and insights not yet recorded on the written page.

The law on codetermination was a composite of the wishes of many groups. The original Guiding Principles, containing the compromises agreed upon by the interest group negotiators, was modified by the Cabinet. The Cabinet could not force its bill upon the Bundestag factions. The majority of the Bundestag's subcommittee voted to modify the bill, to limit severely the scope of codetermination and the influence of the trade unions on the exercise of that right. The Christian Democratic Union's Bundestag

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

faction brought forth a new formula acceptable to the trade unions and enabling a coalition of left CDU and SPD to pass the measure. In Great Britain responsibility and authority are united in a Cabinet backed by a single party in Parliament. In the Federal Republic, because of the plurality of parties, the necessities of coalition government, and the identity of party and interest group, responsibility and authority are fragmented between executive, faction, committee and pressure group.

Chancellor Adenauer, CDU, worked unceasingly to avoid an open conflict within his own party and within his CDU-FDP-DP coalition. During the early stages of the struggle he adopted the conservative strategy of delay. In a long series of conferences and negotiations with the interest groups and parties he sought to reach a compromise acceptable to a convincing majority. The trade unions destroyed this strategy with the decision to strike, if necessary, to secure the rights under German law they had enjoyed during the occupation. As the responsible executive, Adenauer dared not risk the economic paralysis resulting from a strike in the basic industries. On his own initiative and without the consent of all coalition factions the Chancellor cajoled the DGB and industry representatives into signing the Guiding Principles. He then threw his prestige and influence into the battle to transform the Principles into law. Ultimately he could secure only an SPD-left CDU majority for this single issue. Although the majority was decisive, the final vote was an emphatic class division within the Bundestag, a result the Executive had sought to avoid, and an even more emphatic division of the Adenauer coalition.

The traditional theory of parliamentary government is that a majority, one party or a coalition of parties, presents a program for the nation. The Cabinet stands or falls with the success or failure of its chosen course. The Adenauer coalition divided on this important legislation, openly and bitterly, but it did not fall. But a Cabinet stands before the voters on its entire record. A decision on this legislation was achieved without a strike or violence. The new law satisfied the demands of the workers without destroying the rights of property. Adenauer's goal was the retention of the public power; he abandoned the principle of collective responsibility when necessary.

Microfilm $2.85; Xerox $9.80. 217 pages.

HUANG HSING AND THE CHINESE REVOLUTION

(L. C. Card No. Mic 59-734)

Chun-tu Hsueh, Ph.D.
Columbia University, 1958

This is a study of Huang Hsing, co-founder of the Republic of China. The purpose of this study is not so much to paint a portrait of him as to record as accurately and objectively as possible the role he played in the Republican Revolution of China.

Born in Hunan in 1874, brought up in the Chinese tradition, educated in Japan, and influenced by Western ideas, Huang Hsing founded the Hua Hsing Hui for the purpose of overthrowing the Manchu government. After the abortive Changsha revolt in 1904, he fled to Japan, where he met Sun Yat-sen, chairman of the Hsing Chung Hui, in the summer of the following year and joined in the founding of the T'ung Meng Hui. For the first time the revolutionary movement had a unified national organization, and what had been the provincial nature of the two men's leadership became national.

As the military leader of the revolution, Huang was personally in charge of most of the armed revolts, the amateur soldier who commanded by force of his personal courage. He is best known in Chinese history as the gallant fighter in the "Canton Revolution of March 29," 1911. His presence on the scene shortly after the outbreak of the Wuchang Revolution provided the much needed leadership in that leaderless revolution. He was the Commander-in-Chief of the Revolutionary Army defending Hankow and Hanyang. He was the Minister of War when the Provisional Government was established in Nanking on January 1, 1912. When Sun Yat-sen resigned his presidency in favor of Yuan Shih-k'ai after the successful peace negotiation resulting in the abdication of the Manchu emperor, Huang was the Nanking Liu-shou, commanding all the revolutionary troops of the South.

Next to Sun Yat-sen, Huang Hsing was the most important leader in the T'ung Meng Hui. For a short period of a year or so after the success of the revolution, he and his followers emerged as the strongest group in the party. His trip to Peking in September at the invitation of Yuan Shih-k'ai helped stabilize political conditions of the nation and the organization of the government. He advocated parliamentary system.

Realizing the weakness of the military strength of the South against the North, and wishing to put the state on a sound political foundation, Huang Hsing advocated curbing Yuan Shih-k'ai by legal and peaceful methods alone. After the defeat in the war of 1913 against Yuan, Huang took exile in Japan. In July, 1914 he left for the United States and remained there until the last part of April, 1916. He declined to join the Chung Hua Ke Ming Tang organized by Sun Yat-sen in Tokyo because the candidates for membership in this new party were required to take an oath of loyalty to Sun personally and to sign a pledge to that effect with a finger-print as seal.

Huang Hsing was solely a product of the East. His trip to the United States was the first time he had direct contact with the West. The trip seemed to be for travel and observation. He became more active against Yuan Shih-k'ai when the latter attempted to become emperor. On May 9, 1916, just a few days after Sun Yat-sen had left Japan for Shanghai, Huang arrived at Tokyo from the United States. Two months later he returned to Shanghai and resumed his old comradeship with Sun. On October 10 Huang fell ill. Three weeks later he died at the age of forty-two. Microfilm $4.55; Xerox $15.20. 353 pages.

THE POLITICAL FACTORS IN CALIFORNIA'S ANTI-ALIEN LAND LEGISLATION, 1912-1913

(L. C. Card No. Mic 59-608)

James Bewley Kessler, Ph.D.
Stanford University, 1958

"The Political Factors in California's Anti-Alien Land Legislation, 1912-1913," is a study of the role of groups, personalities and other factors in the enactment of legislation of international interest by a state, notwithstanding the opposition of the federal government. The study is based on materials in the Gubernatorial Papers of Hiram W. Johnson, the State Department Papers, the Papers of Woodrow Wilson, William Jennings Bryan, Theodore Roosevelt, Chester H. Rowell, William Kent, Franklin Hichborn, John P. Irish, John Randolph Haynes, James Duval Phelan, David Starr Jordan, Meyer Lissner, and others. These materials were supplemented by interviews with persons who were actively interested in the legislation and who were in Sacramento during the Fortieth Session of the California Legislature in 1913.

Superficially, it appeared that this law was merely the result of pressures on the State Legislature by articulate and cohesive groups representing organized labor and certain agricultural interests. Group agitation unquestionably caused the introduction of anti-alien legislation and influenced its content. However, group activity alone did not decide the issue. Group theorists emphasize the role of groups as a basic political form but tend to forego analysis of the complex of forces which may determine the behavior of groups. One of the effects of the proliferation of these studies is a tendency to obscure the influence of the interaction of individuals, and the importance of communications and perception in determining the constantly shifting motives and attitudes of groups.

The treatment of groups as vectors and of decisions as resultants of group pressures tends to minimize the importance of numerous factors operating through groups, or external to them, the interaction of which has influence on decisions that cannot be explained solely in such terms. Other factors may have greater causal influence upon the framing of public policy, such as place, time, personality, defective communications, etc. This insight is valuable, even though it may be demonstrated that those factors are mediated through groups.

Issues initiated and supported by groups may ultimately be so confused with collateral matters that they become pivotal points for the release of personal tensions, for the competition of political personalities and strategies and for emotional reactions to symbols severally perceived by those influencing decisions. The sudden decision by Governor Hiram W. Johnson of California to support the Anti-Alien Land Law of 1913 cannot be adequately explained in other terms.

Microfilm $2.90; Xerox $10.00. 221 pages.

EXECUTIVE ORGANIZATION AND ADMINISTRATIVE PRACTICE IN THE FOURTH REPUBLIC OF FRANCE

(L. C. Card No. Mic 59-272)

Jerome Babcock King, Ph.D.
Stanford University, 1958

This dissertation describes and analyzes certain relationships between the two groups of officials, elected and appointed, who together constitute the highest decision-making bodies of the Fourth Republic. The purpose is to illustrate the dependence of the politically responsible figures upon the training and expert knowledge of the higher civil servants, and to show the means of their collaboration within the limits set by that traditional fear of an omnipotent bureaucracy characteristic of republican France.

Two approaches have been made. One has consisted in coverage of contemporary literature which, although meagre, has determined the boundaries of the heretofore unexplored territory of the subject. The second has consisted of interviewing a number of selected officials both in and outside of the agencies described, in order to gather skilled opinions on their operations.

The first three chapters of the study survey the general background of modern parliamentary institutions and procedures in France and give an account of the events leading up to the formal establishment of the Office of the Prime Minister, the early evolution of that Office, and its acceptance and development by the new Republic. The last two chapters provide descriptions of the agencies now included within the Office of the Prime Minister, and of the means by which the political figures of the executive makes use of the expert knowledge of the civil servants without at the same time falling under the influence of the bureaucracy as a whole. Of executive elements having an especially important role in the decision-making process the General Secretariat of the Government, the Ministry of Finances, and the system of personal aides to the ministers (the cabinets ministériels), among others, are described.

Conclusions on two different levels have been reached. On the one hand it appears that the Fourth Republic has been the beneficiary of a virtually unheralded administrative reform which has contributed significantly to making those steps on the way to the solution of her problems that France has been able to take since the end of the war. At the same time it seems clear that the political side of the executive has been the real agency of decision and that the role of the civil service, while important, has always been subordinate. It is also shown that the basic problem facing the parliamentary regime is not the strengthening of the executive, which has on occasion been able to act with almost brutal dispatch, but of delineating the appropriate realms within which the executive and legislature ought respectively to act: in brief, to establish an accepted system of checks and balances guaranteeing the legislature a more effective voice in the determination of highest policy as well as a greater measure of stability to the executive. On the other hand it is concluded, paradoxically, that given the great range of social divisions now present in France the parliamentary system, largely because of its inability to deal with the most thorny problems, provides the most suitable form of government for that nation. So long as these social divisions

are not substantially lessened it is believed that only a regime very similar to that of the Fourth Republic will be able to provide a necessary minimum of internal order.

Microfilm $5.50; Xerox $19.20. 429 pages.

POWER AND POLITICS: A COMMUNITY FORMULATES ELECTRIC POWER POLICY

(L. C. Card No. Mic 59-655)

Bert E. Swanson, Ph.D.
University of Oregon, 1959

Adviser: Vincent Ostrom

This is a study of a community and of its inhabitants as they perceive and grapple with the problem of creating a more desirable place in which to live. The key to any such transformation is the community's resources base. This study describes the community as it is related symbiotically to an environment whose primary resources are timber and water. The study observes, describes and analyzes the process of policy formulation. The following model was used in the analysis: Participants with Perspectives pursue Scope Values through Institutions; manipulate Practices by utilizing Base Values as a means of influencing the Outcome.

The Milltown power issue has progressed through five stages. The first was the initiation of the effort to establish a municipal utility as the result of comparable movements taking place throughout the region. The second stage was the series of unsuccessful elections to authorize a municipal utility. The third was the institution of the utility and the creation of a separate utility board to administer the operation of the new city-owned system. The fourth was, and is, the era of competition for customers, for contracts, for the good will of the community. The fifth stage is the attempts presently being made to control and regulate the controversy.

The creation of the municipal utility was conceived as bringing dependable low-cost power and diversified industry to Milltown. While this has been realized, the unanticipated consequences also have occurred. The Milltown system has been subjected to many and varied disturbances. At times these disturbances have threatened to leave the system without the necessary personnel to conduct the operations of its government. From decision-state to decision-state, the main participants have grouped themselves into contending subsystems. They have exhorted those less interested to join their factions. These exhortations have been effective enough to play a major role in the events and states of the community's political system at large.

The character of the differences between the two contending factions has shifted from a focus on natural resources and hydro energy fuels to a focus on the qualities of good citizens in the community. The focus has also shifted to a concern about who shall be the leaders, under what conditions they shall lead and to what ends. The inhabitants of the system are still in the process of resolving natural resources policy. They have not yet decided whether the power distributor shall be a private economic decision-making unit or a public administrative unit. In fact, many of them prefer the personal advantage of the competition existing between the two subsystems.

The system attempted to regulate excessive and harmful disturbances through its own regulatory agency of city government. This attempt failed. The system now has resorted to the Public Utilities Commission, an outside agency, to provide the necessary regulation. In the meantime a neutralism has set in. There has been an effort by the leading businessmen, the mayor, the city manager and others to avoid the issue.

A series of general statements have been derived from this study for future investigation. These are:

A controversial issue arises in the community over values perceived as important to its participants, such as economic, authority, prestige and enlightenment.

The leaders of the opposing factions attempt to make their cause the major issue in the community when actually it may be only one among many significant issues.

The participants in community controversy seek control of the decision-making centers of the community in order to achieve their objectives.

Such direct democratic devices as the initiative, referendum and recall influence the course of community controversy because they are accessible to anyone able to enlist support.

Many different means may be resorted to in order to mediate and reduce the intensity of community controversy:

a. Use of legal agencies in the community,
b. Appeals to outside regulatory agencies,
c. Conferences between the main contenders,
d. Refusal to discuss the controversy,
e. Focus on other tasks requiring community attention.

Regulation of continued community controversy is sought by the participants for the sake of their personal careers.

Microfilm $7.00; Xerox $24.00. 550 pages.

A COMPARATIVE STUDY OF SUCCESSFUL REVOLUTIONS IN LATIN AMERICA, 1941-1950

(L. C. Card No. Mic 59-287)

Lee Benson Valentine, Ph.D.
Stanford University, 1958

The word "revolution" has come to have a special meaning in Latin America. It rarely signifies a deep and moving social upheaval, but rather a sudden and usually superficial political disturbance, whose aim is a change in the head of the government. An apparent upsurge in the number of such revolutions against elected governments in Latin America led to an expression of concern by the government of the United States in 1949. This study was undertaken in an effort to discover if the increase in revolutions was real or imagined; to find out the nature of the revolutions which took place from 1941 to 1950 and the points they had in common; and to search for a key to the causes of these revolutions.

A review of the literature showed that the supposed

causes of Latin American revolutions fell into five general groups: (1) difficulties arising out of the geographical features of the area; (2) problems arising from racial factors, especially involving the mestizo and the Negro; (3) political practices and traditions, such as militarism, dictatorships, and so forth, inherited from the conquest, the colonial period and the struggle for independence; (4) foreign influences of various sorts, usually exercised by other nations, such as the United States; and (5) economic and social demands of the people.

Investigation showed that there were no more successful revolutions in Latin America during 1941-1950 than in the previous decade. However, the early years of World War II tended to decrease the number of such occurrences, while from 1943 on, the number increased. The years 1943, 1944, 1947, 1948 and 1949 produced the greatest numbers of changes of government by force. A total of 196 revolts were reported in the ten-year period; of these, 29 were successful.

It was found that there was a tendency for revolutions to occur in waves, indicating that a successful revolution in one country probably encourages dissatisfied elements in other countries to attempt the same thing. Most of the successful revolutions occurred in the immediate area of the capital of the nation involved. In not a single case did a local caudillo rally his people from the hinterland and take the capital by storm. The successful revolutions originated among the white, or nearly white group. Clashes between different racial groups were not involved in any of them. During the decade, strong influences were exerted by pro-Axis and pro-Ally groups, as well as Communists and Peronistas. However, there is no indication that any successful revolution was directly inspired by such influence. The post-war period saw a rising demand for improvements in the conditions of the working class. This demand was translated into liberal constitutions and regimes. In several countries, revolutions inspired by conservative elements halted or reversed this trend.

Many factors may contribute to a crisis situation. However, successful revolution almost never results unless a leader--either an individual or a small group--takes the initiative and fosters the use of force. This leadership, in the decade 1941-1950, came from the educated, urban class--including the officers of the armed forces--in almost every case. In the final analysis, it appears that responsibility for Latin American revolutions rests not with the masses but with the leaders who are unwilling to abandon that means of achieving their political ends.

Microfilm $3.90; Xerox $13.20. 303 pages.

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

THE ROLE OF THE PRIVATE EXPERT IN THE CONDUCT OF AMERICAN FOREIGN AFFAIRS

(L. C. Card No. Mic 58-7811)

Chadwick F. Alger, Ph.D.
Princeton University, 1958

This survey of the utilization of private experts by the civilian foreign affairs agencies of the United States government discusses these experts under four main categories: consultants, public advisory committees, private members of delegations to international conferences, and those experts who furnish their services under contract. The last group provides research, instruction, and evaluations of government operations; and also conducts operations, primarily in the exchange of persons and overseas technical assistance programs. The private experts are involved in virtually all aspects of the conduct of American foreign affairs, serving the internal needs of the bureaucracy, playing a role in the broader domestic political process and participating directly in foreign relations.

Among the needs of the bureaucracy that private experts supply are certain skills that are in short supply in the government, or that the government cannot acquire or does not need full-time. They also contribute outside perspectives, arbitrate internal disagreements, and provide double-checks for officials on advice given by internal experts.

In the broader domestic political process private experts, particularly public advisory committees, serve to bridge the separation of powers by acting as watchdogs over executive agencies and by providing Congress with independent judgments of executive programs. They also serve as a source of patronage, facilitating agency relations with political parties; and provide a mechanism whereby various private interests can be satisfied, in which experts representing these groups are both educated and given the opportunity to influence governmental decisions.

In overseas relations private experts sometimes lend their prestige to American efforts at the negotiation table, and their appointment often brings public notice not accorded to regular personnel. They also help to depoliticize negotiations on problems that are subjects of domestic controversy, and are able to speak with more frankness in areas of the world that are sensitive to American criticism than could governmental officials. Finally, the use as advisers of leaders of private American philanthropic and business organizations operating overseas helps to coordinate these private activities with overseas operations of the government.

Great expansion in the use of private experts occurred during and following World War II, but there has been a decrease in their use in some areas since 1953, notably in the category of individual consultants. Three reasons for this decline are discerned: changes in foreign policy leadership, administrative changes, and security considerations. It is concluded that more stringent security requirements have probably had the most pronounced effect.

The period 1953 to 1956 is covered in detail and is

supplemented by some earlier information in order to furnish historical perspective. Much information for this study was drawn from congressional files that contained detailed executive responses to congressional inquiries on the use of private experts. This has been augmented by some sixty interviews of governmental officials and private experts used by the government. Other information has been found in congressional hearings and reports, in other government documents, and in memoirs and biographies. Microfilm $5.10; Xerox $17.00. 399 pages.

AMERICAN FOREIGN RELATIONS WITH EAST CENTRAL EUROPE, 1823-1867: HUNGARY AND POLAND

(L. C. Card No. Mic 59-927)

Charles Allan Baretski, Ph.D.
University of Notre Dame, 1958

The purpose of this study is to provide a documented account of the historical development of American foreign relations with two nations of East Central Europe, Hungary and Poland, during 1823-1867.

Official correspondence and state papers were examined to gauge the role of the Hungarian and Polish Questions in American diplomacy. The first three chapters present introductory historical and political background material. Five chapters next describe the course of these relations. Following a summary chapter, appendixes and "Note on Bibliographic Method," a bibliography of sixty-three pages is given.

During the formative period of America's foreign policy (1775-1823), the Hungarians and the Poles could look back upon an almost 1,000-year old national tradition. A brief description of that history is afforded.

During the era under review, the Hungarians and Poles achieved a brief independence. The American Government, however, did not maintain diplomatic relations with either nation but with their overlords, viz., Austria, Prussia and Russia. Nonetheless both Hungarians and Poles had developed strong traditional ties of friendship with America. For these nations, the United States served as a bulwark of moral and ideological support for their independence movements.

The United States officially remained aloof during the Polish Insurrection of 1830. Nevertheless American diplomats at St. Petersburg, Randolph of Roanoke, John R. Clay and James Buchanan, attacked tsarist despotism in Russian Poland. The American press meanwhile espoused the Polish Cause. Because of a legal technicality, a Congressional land grant for Polish exiles became inoperative.

In 1846, lesser-known but also futile Polish insurrections broke out in Galicia, Cracow and Poznań. The Republic of Cracow was thereupon annexed by Austria. Henry Wheaton, William Stiles and John R. Clay, American diplomats, expressed sympathy for the Poles.

In 1848, Poles again revolted in Cracow, Lwów, and Poznań. American ministers abroad again championed the insurgents but to no avail.

American-Hungarian relations at mid-century are next examined. Early American attempts at mediation in the Hungarian Revolution failed. A. Dudley Mann's mission to Hungary likewise came to naught. On the other hand, the State Department successfully intervened to free Louis Kossuth from Turkish exile. Secretary Daniel Webster's Note to Chevalier Hülsemann, Kossuth's American tour, the Congressional land grant for Hungarian exiles and Secretary William L. Marcy's handling of the Martin Koszta Case subjected Austro-American relations to further strain.

In 1863, the Poles in Russian Poland rebelled and vainly sought America's diplomatic support and recognition. Secretary William Seward's non-intervention policy accordingly won Russia's favor. Senator Charles Sumner's pro-Polish sentiments clashed with Minister Cassius M. Clay's Russophile views. On the whole, the misinterpreted visit of the Russian Fleet in 1863, the impact of Count Adam Gurowski's Pan Russism and the ambivalent nature of the American press on the Russo-Polish conflict promoted the betterment of Russo-American relations and tended to hamper the development of a more favorable official attitude towards the insurgent Poles.

Despite many popular manifestations in favor of the Magyars and Poles, the State Department, with few exceptions, officially followed the traditional policy of non-interference in foreign conflicts. In reality, the American Government pursued an independent course in foreign policy. That policy was a product of many interacting factors.

The conclusion which is drawn from the investigation is that America's practical needs and material interests during 1823-1867 had little in common with the political aspirations of the Hungarians and the Poles.

Microfilm $6.60; Xerox $23.00. 519 pages.

BIPARTISANSHIP: A CASE STUDY OF THE FOREIGN ASSISTANCE PROGRAM, 1947-1956

(L. C. Card No. Mic 59-165)

Bonita Isabelle Hunt, Ph.D.
The University of Texas, 1958

Supervisor: J. Lloyd Mecham

This study was designed to throw light on bipartisanship in American foreign policy. The broad problem of bipartisanship is our major concern, but a real understanding of the problem can be attained only by analytical studies of various segments of the foreign policy. Only after such studies can conclusions be made concerning the implications of bipartisanship in American foreign policy. This case study is made, therefore, on only one important segment of foreign policy, the foreign assistance program.

The study includes the following eight cases: The Truman Doctrine, the European Recovery Program, the North Atlantic Treaty, the Mutual Defense Assistance Act of 1949, the Point Four Program, the Mutual Security Act of 1951, the Mutual Security Act and the Eighty-third Congress, and the Mutual Security Act and the Eighty-fourth Congress.

Each foreign aid program considered in this work was approached by a study of the formulation of policy proposals, the public's reaction to policy proposals, and

Congressional reaction to policy proposals. Conclusions were then drawn as to the role of bipartisanship in the making of each policy.

In this study an attempt was made to explore the characteristics of the bipartisan process and to analyze practices as they were used in the formulation and acceptance of foreign assistance policies. The following bipartisan practices were considered: consultation between the Executive Department and party leaders, liaison relations between the Executive and Congress, bipartisan support in Congress, elimination of party consideration in policy decisions, and appointment of minority party members as delegates to international conferences and to other responsible policy-making roles.

Particular attention was given to the major problem of executive-legislative relations, to attempts to strengthen those relations through bipartisan cooperation, and to the effect of cooperative interdepartmental relations in bipartisanship.

In analyzing bipartisan support in Congress, there was an effort made to weigh legislative leaders and their role in the bipartisan process. Attention was given to Democratic and Republican cleavages and to sectionalism and its effect on bipartisanship.

The conclusion was that majorities in Congress are likely to be bipartisan. In the foreign assistance program there was a high degree of two-party support. That support reached its zenith when executive-legislative relations were at their best. Sectionalism was a major cause in the breakdown of party unity, and the acceptance of bipartisanship did not alter the general pattern of regional voting.

It was concluded that as long as we have our present constitutional system and a party system that lacks responsibility, we will have bipartisanship operating in the conduct of foreign policy. As long as there is an external force threatening the security of this country and of the "free world" there will be patriotic conviction upon the part of the American people that there must be unity; thus there will be bipartisanship in American foreign policy.

Microfilm $5.90; Xerox $20.60. 462 pages.

POLITICAL SCIENCE, PUBLIC ADMINISTRATION

ADMINISTRATIVE REGULATION OF COMMERCIAL AIR TRANSPORT

(L. C. Card No. Mic 59-159)

Reverdy Thomas Gliddon, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Emmette S. Redford

This is a study of air transport economic regulation by the Civil Aeronautics Board. Inquiry is focused upon administrative aspects of national programs promoting and regulating the domestic airline system of the United States as a component of all activities contributing to development of the industry.

Air transport regulation brings new problems to American traditions of regulatory control. Air transport technology is extraordinarily dynamic and complex, which creates an unusual need for attention to technical problems if administrative decisions are to be dependable. Air transportation, being a new method of transport, is also conditioned by patterns of commerce and travel which antedate it, and which grew out of previous revolutions in mechanical land transport created by the railroad and highway systems. These factors relate directly to business and government practices in designing and regulating air service patterns.

Analysis of administrative activity must therefore proceed on the assumption that technology, habits of commerce, and governmental institutions have continuously exerted influences upon events in air transport regulation. This is demonstrated in the search for organizational forms which led to the Civil Aeronautics Act of 1938, and in subsequent experience under the Civil Aeronautics Board which was thereby established. In 1957, nearly two decades after passage of its organic legislation, the Board continued to experience new jurisdictional conflicts with several other governmental agencies participating in air travel promotion and regulation.

The interplay of dynamic forces is also seen when one views the Board directly as a political institution. Several assumptions used to justify the commission form of regulation are not borne out in Board practices. Impartiality, group deliberation, expertness, and continuity of policy--assumed to be attributes of commission forms--are often absent, or do not produce the results anticipated. Examination of policy-formation processes as they are actually carried on reveals the Board operating in an atmosphere of legislative, judicial, executive, and business influences, some of which are beyond control of the Board, and which orient policy toward demands of operating businesses in the airline industry. The centrality of formal adjudicatory procedures in Board activity has made it neither an impartial court-type agency nor an organ which effectively discharges its responsibilities for formation of public policy.

Over the years, the Board has not developed a consistent plan of air transport development, but has evolved administrative approaches which reveal growing traditions in patterns of regulation. Among these are many business objectives necessitated by utilizing air-line companies as operating units. Because of the emergence of air transport as a multi-service mode of travel, the agency has also been forced to concern itself with service evolution, in which consumer demands, new forms of air transport, and geographical area considerations move beyond program objectives previously conceived. Finally, economic phases of air transportation merge with other public considerations, making it impractical to consider economic regulation separately from safety, technology, and private use of aviation facilities. The position of the Board in 1957 remained, therefore, one in which the jobs of industry management were most fruitfully conceived as an integrated whole, not marked by dualism between economic and other social forces.

Microfilm $5.20; Xerox $18.40. 408 pages.

TELEVISION ALLOCATION POLICY: AN ADMINISTRATIVE SEARCH FOR THE PUBLIC INTEREST

(L. C. Card No. Mic 59-169)

William Astor Kirk, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Emmette S. Redford

Administrative regulation of television broadcasting by the Federal Communications Commission involves performance of three basic regulatory functions. First, bands of frequencies (broadcast channels) must be allocated to television as an authorized radio service. Second, the channels must be apportioned among eligible cities and metropolitan areas. Third, individual stations must be licensed to operate on specified channels in accordance with prescribed rules, regulations, and engineering standards. The first two functions are referred to as "allocation phases" of television regulation.

This study examined FCC performance of the allocation phases of commercial television regulation. Execution of these functions is accomplished through exercise of the FCC's quasi-legislative powers. The generic statutory standard governing such action is "public interest, convenience, and necessity." Congress regards the public interest criterion as a relevent norm for administrative decision making in television regulation.

The purposes of the study were (1) to ascertain the FCC's concepts of "public interest" in the context of television allocation determinations, and (2) to determine the relationship, if any, between such concepts and those generally found in the literature of public administration.

Allocation of radio frequencies to television is greatly influenced by the fact that the total demand of all radio services for such frequencies exceeds the available supply. Television frequency allocation is a conscious social process; it necessitates evaluation of the relative social utility of television broadcasting. In 1945, the FCC allocated 13 (later reduced to 12) VHF (very high frequency) broadcast channels to television. Recognizing that this limited allocation would not provide an adequate basis for a nationwide competitive television service, the FCC authorized experimental telecasting in an undeveloped UHF (ultra high frequency) band reserved for future use of television. The 70 channels in this band were opened to commercial exploitation in 1952. Thus, our national television system is based on the utilization of 82 broadcast channels -- 12 VHF and 70 UHF channels.

Apportionment of these channels among cities of the United States is an exceedingly complex task. It requires administrative consideration of many complicated technical, social, and economic factors. In this decisional context, interest groups make a great impact on the administrative process.

The FCC has attempted to give specific meaning to the broad public interest standard by (1) emphasizing that justification of television depends on the service rendered to the public, rather than on the private interests of broadcasters; (2) seeking to achieve a nation-wide television service; (3) encouraging the establishment of at least one television station in as many communities as possible, insisting that such station serve as a medium of local self-expression; and (4) endeavoring to achieve multiple services in as many communities as possible to provide adequate program choice to the public and to promote competition among all components of the television industry.

The study led to the following general conclusions: First, from the standpoint of theoretical content, the FCC's concept of "public interest" belongs in the same ideological category as the older political ideas of "public welfare," and "general welfare." Second, the public interest concept is also associated in the minds of commissioners with the idea of maximization of individual welfare. Third, the experience of the FCC indicates that interest group phenomena are among the most dynamic and pervasive factors affecting administrative decision making. Fourth, in some regulatory situations, comprehensive analysis of all relevant situational factors will disclose opportunities for positive, constructive, and creative action in defining the scope and direction of public policy. Fifth, one of the most difficult problems in television regulation is that of evolving procedures to cope with sharp divergencies of opinion among technical experts on technical matters essential to sound regulatory policy. Sixth, administration in the public interest requires capacity for foresight, ability to discern secular trends, and conviction that sound administrative decisions are judgments made in the light of possible future developments as well as emergent problems.

Microfilm $4.75; Xerox $15.80. 370 pages.

STATE ADMINISTRATIVE SUPERVISION OF TOWN GOVERNMENT IN VERMONT

(L. C. Card No. Mic 58-2313)

John Perry Wheeler, Jr., Ph.D.
Syracuse University, 1958

Supervisor: Spencer D. Parratt

This is a study of state administrative supervision of town governmental functions in Vermont. Five functional areas are covered--finance, public health, social welfare, education, and highways. "Supervision" as used in this study refers to any action on the part of a state official directed toward getting a town officer to perform his functions in a way deemed desirable by the state official. In addition, certain non-administrative supervisory relationships will be dealt with, such as state financial aid and certain phases of legislative supervision.

Three questions are answered by this study. First, what are the supervisory relationships between the state officials and their town counterparts in Vermont? Second, have the tendencies toward centralization identified elsewhere appeared in Vermont? Third, if such tendencies have presented themselves, in what form have they appeared?

State administrative supervision of town activities in Vermont--where the base for such supervision has been established--has emphasized the noncoercive. Even in the few instances where coercive techniques are legally available to state administrators the latter seldom use them. State supervision comes primarily in the form of assistance--advisory, technical, and financial.

In the field of finance there has been no important change in the legal relationship between the state and the town since 1910. The state, however, has been steadily increasing the degree of its supervision through the provision of advice and service. In the field of social welfare the state has assumed the responsibility for the direct administration of the programs of categorical assistance. The town is still responsible for administration of general relief and in this is little supervised by the state. The Department of Health has emerged as a local health unit for the state, providing most of the services usually provided by a local health organization. Very few towns are doing anything worth noting in the field of public health. State supervision over the local administration of public education has increased tremendously since the turn of the century. Towns have become heavily dependent upon the state for financial aid, and the prescriptive powers of state educational administrators are effective in a number of functional areas. Professional supervision of schools now prevails throughout the state. The Department of Highways now controls outright the state highway system, has extensive control over the state aid system, and through financial and technical assistance has extensive supervisory powers over the town highway system.

Pressed by the social forces of modern society the system of government and particularly that of inter-governmental relationships in Vermont are changing. The form of government remains largely the same, but its operation is different. Readjustment seems to be taking several forms. First, the state is increasing its financial aid and services to towns. Second, the state is assuming the responsibility for the direct administration of certain functions; this is particularly true in the fields of social welfare, highways, and public health. Third, there is increasing inter-town cooperation in the use of facilities and equipment; this is particularly true in the fields of highways and education. And fourth, functional consolidation is in the early stages of development; the chief example of this is the creation of the union school district which permits two or more town districts to unite for the purpose of providing schools.

These trends may be expected to continue although there will probably be no fundamental reconstruction of the system of government particularly at the town level.

Microfilm $6.45; Xerox $22.60. 506 pages.

PSYCHOLOGY

PSYCHOLOGY, GENERAL

THE DISPLACEMENT OF HOSTILITY

(L. C. Card No. Mic 59-155)

Jean Emery Ferson, Ph.D.
The University of Texas, 1958

Supervisor: Professor Philip Worchel

The experiment was conducted in order to study the displacement of aggressive responses as a function of the similarity between the objects presented for displacement and the original frustrating agent.

Several theoretical orientations to displacement were reviewed. The scapegoat theory of prejudice predicts that objects remote from the source of frustration will be preferred as targets for displaced aggression. Miller has proposed a theory based on conflicting approach- and avoidance- tendencies which generalize from the original frustrating situation to similar ones. He predicts that the displaced response will occur to the first similar stimulus for which approach-tendencies are greater than avoidance-tendencies. Measurement of the similarity dimension is a critical problem in his analysis. He suggests using response strength as a measure of similarity, but Bush and Whiting have criticized him for circular reasoning on this point. They suggest a probability model for predicting the displaced response, using a "similarity index" based on the number of identical stimulus elements in the training and test situations. Worchel has emphasized the need to vary the similarity of the displacement objects in relation to the frustrating object. He has suggested presenting a series of objects the position of which on a relevant similarity dimension is known. He has also pointed out the importance of personality variables in predicting the expression of aggression.

The experiment was designed to test two predictions:

1. When the objects presented for displacement are related to the original source of frustration on the basis of a relevant dimension of similarity, aggressive responses will be displaced.

2. On the basis of previous research by Worchel relating Self-Concept Theory to the readiness to express aggression, it was predicted that Ss with low Self-Ideal discrepancy scores will express more aggression toward authority figures than Ss with high Self-Ideal discrepancy scores.

Seventy-two University of Texas undergraduates served as Ss in a randomized-replication design. There were two experimental conditions, Hostile and Non-Hostile. Under the Hostile condition, a professor played the role of frustrator by administering a difficult test under stress. The four stimulus objects presented for displacement were ranked on a descending scale of academic authority: Professors, Teaching Assistants, Graders, and Students. The Ss were asked to rank these four groups on an attitude questionnaire. The scores of the Non-Hostile Ss furnished a baseline by which to evaluate the scores of the Hostile Ss. Displacement was defined as an increase in hostile attitudes directed toward objects other than the instigator, the Professor.

The first prediction was confirmed. When the mean scores for the four categories under Hostile and Non-Hostile conditions were compared, there was no significant difference in the Professor category, but there was

a significantly more hostile evaluation of Teaching Assistants. The second prediction was not confirmed. There were no significant differences in the expression of aggression between High and Low Self-Ideal Ss.

The results have been discussed in terms of their implications for Miller's theory of displacement, the scapegoat theory of prejudice, and Worchel's theory of hostility in relation to Self-Concept theory. The approach-avoidance analysis advocated by Miller seems at present most satisfactory to explain the displacement of aggression.

Microfilm $2.00; Xerox $5.40. 109 pages.

VARIABILITY AS A FUNCTION OF INTELLIGENCE AND INCENTIVE

(L. C. Card No. Mic 59-163)

Laurel Hessler Hodgden, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Harold Stevenson

This study is primarily concerned with differences in preference for variability as a function of intelligence level, etiology of mental deficiency and the amount of incentive. Differences as a function of mental age and sex are also investigated. Preference for variability refers to the variations of response made by the organism when there is no demand for such variability from the environment.

Dodge, Lepley and others have concluded that such variability is a normal attribute of organisms and a number of animal studies have been done on the effects of cortical damage and differences in incentive on variability. Almost no work has been done with human subjects, however, and most of the conclusions concerning their preference for variability have been drawn from studies on the broader problem of rigidity. The work of Lewin and Kounin who have held that rigidity is a primary attribute of the mentally deficient has been cited to show that mentally deficient children have lower preference for variability than normal children. More recent work, however, has led to the hypothesis that, in most cases, the amount of rigidity and variability shown by an individual results from a number of factors rather than from basic rigidity which is a function of intelligence level.

Forty children were used in each of four groups: exogenous feebleminded, endogenous feebleminded, average and bright. Half of each group had mental ages from five through six years and half from eight through nine years. Equal numbers of boys and girls were used in each group.

The apparatus was adapted from the type used in animal studies of the same problem. The task was to take a car from the starting point to the goal. In the first portion of the experiment there was a choice of two routes. One path remained fixed throughout and the second was different on each trial. In the second portion of the experiment, the child was free to reach the goal in any way he chose. The groups were also divided as to level of incentive. In one the only reward was that intrinsic in performing the task. In the second, the subject received a trinket on each trial.

The primary measures used for analysis were the total number of different paths taken in the two-choice situation and the total number in the free-choice situation. A difference score was computed to determine preference for long or short paths. The subjects were also scored for originality of responses.

No significant differences in variability were found among the groups in the two-choice situation where the alternative choices were clearly outlined. In the free-choice situation significant differences were found with the feebleminded showing significantly less variability. The feebleminded subjects also had significantly lower originality scores and showed greater differences between high and low incentive conditions than did normal subjects. Significant differences were also found between the mental age levels with the higher level subjects being more variable. There were no significant sex differences in variability scores.

It was concluded that preference for variability is affected more by various situational factors such as the amount of creativity required by the task and the amount of incentive than by intelligence level.

Microfilm $2.00; Xerox $5.00. 98 pages.

TRANSFER TO A DISCRIMINATION TASK AS A FUNCTION OF AMOUNT OF STIMULUS PRETRAINING AND SIMILARITY OF STIMULUS NAMES

(L. C. Card No. Mic 58-5852)

Hayne Waring Reese, Ph.D.
State University of Iowa, 1958

Chairman: Associate Professor Charles C. Spiker

The experiment was designed to test two predictions derived from Miller and Dollard's hypothesis of the acquired distinctiveness of cues: (a) that there will be greater facilitation of Task II performance in a group which has learned to associate dissimilar nonsense syllables with the stimuli than in a group which has learned to associate similar nonsense syllables with the stimuli, and (b) that the difference will be greater when the associations have been learned to a high level during pretraining than when they have been learned to a lower level.

Six stimuli were used, and were divided into three pairs with high within-pair similarity. Two pairs were used in Task I, and all three pairs were used in Task II. In Task I, one group learned to associate dissimilar nonsense syllables (Pairs C and D) with the stimuli, and a second group learned to associate similar nonsense syllables (Pairs A and B) with the stimuli. For each group the stimuli of one pair were presented until the associations with the syllables were learned to a high criterion, and the stimuli of the other pair were presented only one-third as many times. Immediately after S reached the Task I learning criterion, Task II was begun. In Task II Ss learned to associate push-button responses with the stimuli.

Analyses of the Task I data indicated that associations with Pair B ("wug" and "wog") were more difficult to learn than associations with the other pairs of syllables, and that there was greater within-pair confusion within Pair

B than within the other pairs, indicating that the formal criteria for judging similarity of the syllables were inadequate.

Analyses of the Task II data indicated that pretraining with Pair C ("lev" and "mib") and Pair D ("wug" and "zam") led to facilitation of Task II performance relative to the no-pretraining condition. The facilitation was equally great for both levels of pretraining. The low level of pretraining with Pair A ("zim" and "zam") and with Pair B did not lead to facilitation. The high level with Pair A led to facilitation, and the high level with Pair B had no significant effect. For the low level of pretraining there was significantly less facilitation for Pair A than for the dissimilar pairs. For the high level there was significantly less facilitation for Pair B than for Pair A or for the dissimilar pairs, and there was no significant difference in the amount of facilitation for Pair A and the dissimilar pairs.

The first prediction was supported. Alternative interpretations of the data relevant to the second prediction were discussed.

Microfilm $2.00; Xerox $3.00. 60 pages.

YOUTHS' ATTITUDES TOWARD SCIENCE AND SCIENTISTS RELATED TO RELIGION, FAMILY, SOCIAL CLASS AND OTHER VARIABLES

(L. C. Card No. Mic 58-3192)

Dorothy Gates Rodgers, Ph.D.
Purdue University, 1958

Major Professor: Dr. H. H. Remmers

A questionnaire containing questions concerning attitudes toward scientists and science, independence from the parents, and religious beliefs and practices was administered to a national sample of 10,000 high school students participating in the Purdue Opinion Panel in October 1957. A sample of 2,000 students stratified on the variables of region, grade in school, sex, and rural-urban residence was drawn for analysis from the initial returns.

The major purposes of this research were to measure the attitudes of high school students toward science and scientists and to test hypotheses concerning factors related to the direction and intensity of these attitudes. Science was defined as a social activity which is characterized by universalism, communal equity, disinterestedness and organized skepticism. A scientist was defined as an individual who is engaged in the social activity of science and whose role implies belief in the tenets of universalism, communal equity, disinterestedness and organized skepticism. The items written to measure each of these areas of content were subjected to Guttman's scale analysis procedure. These analyses indicated that the items qualified as "quasi-scales." The items written to measure religious orthodoxy and independence from parents were subjected to the same type of analysis. Religious orthodoxy items met the criteria of a scale, and independence from parents met the criteria of a "quasi-scale." Internal consistency estimates of reliability for the four scales indicated that they were homogeneous in function.

A theoretical framework was developed on the basic assumption that science is a part of the "process of rationalization." It was further assumed that when this dynamic process takes place at the level of ideas and symbols it tends to disrupt established symbolic systems producing a negative reaction in more traditional groups which are dependent upon these established symbolic systems for security, stability and orientation. From this assumption hypotheses were derived to the effect that individuals could be differentiated on their attitudes toward science and scientists on the basis of their adherence to or rejection of certain traditional ideas and groups, namely, religion, family, social class and sub-cultural areas such as region and rural-urban residence. Hypotheses were also tested, by means of analysis of variance designs, concerning the interrelationships of these traditional groups and ideas. In general these hypotheses were substantiated. When these variables were related to attitudes toward science and scientists, it was found that generally they differentiated among individuals with varying attitudes toward science and scientists. Implications for further research were discussed.

Microfilm $3.00; Xerox $10.20. 230 pages.

AN ANALYSIS OF SMALL GROUPS BY THE USE OF TRANSPOSE FACTOR ANALYSIS

(L. C. Card No. Mic 59-420)

Royce Russell Ronning, Ph.D.
The Ohio State University, 1958

The purpose of this study was to examine the relationships among groups of individuals by the use of the inverse or transpose factor technique. The major hypothesis of the study was that such an analysis would result in a pattern of interpretable factors which would yield insight into the nature of the groups as a result of the contribution of each member of the group.

A total of seventy-one measures was obtained for each of twenty-nine groups of students from an introductory course in Educational Psychology. The measures were obtained prior to, during, and at the end of the five-week period during which the group met daily.

The twenty-nine groups were intercorrelated on the variables, yielding a 29 x 29 correlation matrix. This transpose matrix was factor analyzed by a variation of the Thurstone multiple group method.

Thirteen orthogonal factors were extracted from the matrix and rotated to meaningful structure. Eight of the factors with sizeable loadings on five or more groups appeared quite clearly defined. The remaining five consisted of factors on which one group had a sizeable loading, and one or two other groups had small but interpretable loadings. These factors were tentatively identified, largely on the basis of the characteristics of the single group with the high loading.

The major premise of the study, that a factor analysis of the intercorrelations among groups would yield useful and interpretable factors, appears to be justified.

Microfilm $2.00; Xerox $3.00. 60 pages.

WORK MEASUREMENT AND PERCEPTUAL STUDIES WITHIN A UNIVERSITY COUNSELING CENTER

(L. C. Card No. Mic 59-431)

Randolph Sterling Thrush, Ph.D.
The Ohio State University, 1958

This study attempted to answer, by a behavioral description of staff activities and by a perceptual study of counselors' beliefs and attitudes about individual behavior and organizational tasks, two general questions: (1) How do the counseling and clerical staff members of the Ohio State University Counseling and Testing Center spend their time during the work day, and how may this be measured reliably? (2) How do the counselors at the Center perceive and respond to particular aspects of their jobs?

From the last question the following specific hypotheses were tested: (1) The correlation between the counselor's actual work behavior, as observed by the experimenter, and the counselor's perception of his behavior is not significantly different from zero. (2) The counselor's actual behavior, as observed by the experimenter, is more closely related to the counselor's preference than to the counselor's perception of the requirements of the job. (3) The counselor's perception of the actual distribution of his time is more closely related to his perception of the agency work requirements than to his preferred distribution of time.

The activities of the staff members were categorized, and nearly 11,000 observations were made during a two-month period. Work sampling was the method used. The method consisted of selecting samples of behavior at random. When a sufficient number of samples had been selected, a prediction was made for the amount of time spent on a particular behavior.

At the end of the descriptive study the counselor's allocation of time was described from four different frames of reference: the experimenter's observation of the counselor's work behavior for a specific period (A), the counselor's perception of his work behavior for that period (B), the counselor's preference for work time allocation (C); and the counselor's perception of the agency's required allocation of working time (D).

The results of the work sampling were expressed in percentages, for the number of observations within a particular work activity were divided by the total number of observations. The percentages were computed for different categories and combinations of categories and, also, for different workers and combinations of workers.

Hypothesis 1 was rejected. As a group, the counselors at the Center could state better than chance how their time had been spent over a particular period; individual counselors, however, might have somewhat distorted views.

The correlation between C (the counselor's preference) and D (the counselor's perception of the job requirements) was .99. Since these two conditions were practically identical, Hypotheses 2 and 3 were rejected.

As measured by this study, only three work descriptions were elicited: (1) the counselor's actual behavior (A), (2) his perception of this behavior (B), and (3) his preferred or required distribution of time (C-D). It was found that the counselor's perception of the way his time was distributed was more closely related to his perception of his preferred or required allocation of time than it was to his actual work behavior. Stated another way, A was less closely related to C-D than was B.

These conditions are described as the counselor's manifestation of his motives (A), his awareness of the behavioral consequences of his motives (B), and his perception of his motives (C-D).

Microfilm $2.70; Xerox $9.40. 207 pages.

PSYCHOLOGY, CLINICAL

PERSONAL CONSTRUCTS AND COGNITIVE STYLES

(L. C. Card No. Mic 59-167)

James Gordon Kelly, Ph.D.
The University of Texas, 1958

Supervisor: Professor Louis J. Moran

Purpose: The Study was designed to assess the validity of Personal Construct Theory by specifying correlates of two dimensions of the theory and testing hypotheses concerning these correlates. The two dimensions were permeability-impermeability and propositionality-preemptivity.

Theoretical Terms and Operations: A permeable construct is defined by the theory as one which "will admit to its range of convenience new elements which are not yet construed within its framework." Permeability was operationally defined as the number of cells filled in the Role Construct Repertory Test. A propositional construct is defined by the theory as one which "leaves its elements open to construction." The operation for the propositionality dimension was the sum of scale score values on the Role Construct Realms Test, created for the study.

Method: Seven cognitive tasks were employed for testing 13 predictions; two object sorting tasks, a theme sorting task, an object uses test, a theme interpretations task and two concept attainment tasks, one conjunctive and one disjunctive.

Subjects: Seventy undergraduate psychology students served as subjects. Intelligence test data (A.C.E. scores) were collected on the total sample and retest data was collected on a portion of the sample.

Predictions: Permeable subjects were predicted to include more objects in their conceptual sortings, and thereby to be more open, according to conceptual area analysis; to include more individual themes in their groupings; and to attain a conjunctive concept. In attaining this concept, permeable subjects were expected to require fewer number of trials, fewer number of hypotheses, but would vary more attributes in their successive choices than would impermeable subjects.

Propositional subjects were predicted to attribute more uses to objects as well as to offer more interpretations to themes. Propositional subjects were also predicted to attain a disjunctive concept. In attaining this concept they were expected to require fewer trials and hypotheses for solution but vary more attributes of their choices.

Results: Data analyzed by correlational techniques were evaluated as confirming a hypothesis regarding permeability and open conceptualizations of objects beyond the .01 level for a one tail test (r = .28. When Total A.C.E. scores are partialled out, r = .45). The null hypothesis was held to be tenable for other predictions for the permeability dimension. Propositional subjects were found to vary more attributes in attaining a disjunctive task than preemptive subjects beyond the .05 level for a one tail test (r = .22. When Quantitative A.C.E. scores are controlled, r = .23). All other predictions for the propositionality dimension resulted in accepting the null hypothesis. Negative findings were evaluated as largely reflecting ambiguities in the theoretical language.

Microfilm $2.35; Xerox $8.20. 177 pages.

AN INVESTIGATION OF SOME ASPECTS OF DEPRESSION AND ITS EFFECT ON THE PERCEPTION OF THE SELF AND OTHERS IN A NON-PSYCHIATRIC POPULATION

(L. C. Card No. Mic 58-5922)

Esther Mullen, Ph.D.
New York University, 1958

Chairman: Professor Bernard N. Kalinkowitz

This investigation was an attempt to study some aspects of personality theory concerning depression, utilizing a non-psychiatric population. It was primarily concerned with exploring the concept that observations from a pathological population can be extended to a non-pathological population. The primary focus of the present study was the connection between depression and self-hate.

It was hypothesized that there was a relationship between depression and self-hatred in that the depressed person would underestimate his status in the group more than the non-depressed person. It was further hypothesized that the depressed person would perceive of himself as more similar to the one he dislikes than the one he likes, while the non-depressed person would perceive of himself as more similar to the one he likes than the one he dislikes. It was further hypothesized that the more depressed person would be less aware of whom he perceived of as most similar to himself than the non-depressed person. It was further hypothesized that the depressed person who is aware of his depression would differ in his perception of himself from the person who is not aware of his depression.

The population of this study consisted of thirty-six white, male, college students, all members of college fraternities. The subjects were divided into six groups, with each group being made up of six individuals who were members of the same fraternity.

Each subject was given the group form of the Minnesota Multiphasic Personality Inventory. The Depression Scale score obtained on this test was used as one rating of depression. A significant Depression Scale score was considered as a sign of the subject's awareness of depression. The Rorschach test was administered to all subjects. These responses were examined by three judges and evaluated for the degree of depression present. The judges gave each subject two depression ratings; one was the determination of the presence or absence of significant depression and the other was the relative degree of depression present as compared to the rest of his fellow group members. The presence of depression as determined by the Rorschach test was used as the indication of underlying depression.

Each subject was required to Q-sort a questionnaire for himself, his ego ideal and for all five of his fellow group members. Each subject ranked all his fellow group members according to preference and indicated how he thought each would rank him. Correlations between the self-sorts and the sorts for fellow group members were used as the measure of assumed similarity. Differences between the actual preference ranks and the assumed preference ranks were used as measures of awareness of group status.

None of the four hypotheses was upheld by the data. There were no statistically significant differences between the depressed group and the non-depressed group in any of the areas investigated.

The data of the present study did not uphold earlier findings which suggested that most people tend to identify with those individuals they like. While not a conclusion of this study, which was not set up to investigate these factors, these results are worthy of note. A significant difference in identification was found between subjects who felt similar to their ego ideals and subjects who felt distant from their ego ideals. The former tended to identify with liked individuals more than the latter.

It was concluded that there is no relationship between depression and self-hatred within a non-psychiatric population and that application of other pathological findings which have not been experimentally verified for the normal population, might be of equal error.

Microfilm $2.00; Xerox $6.60. 123 pages.

CATHARSIS AND THE ROLE OF PERCEPTUAL CHANGE IN THE REDUCTION OF HOSTILITY

(L. C. Card No. Mic 59-175)

Leo Alexander Pirojnikoff, Ph.D.
The University of Texas, 1958

Supervisor: Professor Philip Worchel

The purpose of this study was to investigate the predictions derived from two theories concerning the relationship of catharsis to the reduction of hostility. In addition, the discrepancy between self and ideal was evaluated in relation to the effects of the cathartic procedures.

From eight sociology classes four groups were randomly assigned to each of four conditions, replicated twice, with different assistants. An additional two groups were employed to determine the changes occurring with further manipulations of the experimental conditions.

All groups were given an intelligence test by the E in a manner calculated to arouse feelings of hostility. In the Cath.-Role Chng. condition, Ss were asked to express feelings for five minutes and for the remaining five minutes the A attempted to change S's perception of the E by providing him with new, more acceptable, and neutral

roles. In the Cath.-Neut. condition, the cathartic procedure was followed by a neutral period involving the discussion of the choice of a sociology major. The Neut.-Neut. control provided a full ten minutes of the neutral condition. The Neut-Role Chng. condition combined five minutes each of the neutral and role change procedures. The two additional groups used the same procedures as were presented in the Cath.-Role Chng. and Neut.-Neut. conditions with the exception that only half of the intelligence test was administered under hostility-arousing conditions. The remaining subtests were completed after the intended treatments, without any further frustration by E.

A pre- and post-test of digit-symbol was employed to measure the effect of the relief of hostile feelings on performance. A questionnaire, called the "Rating of Test Administration," was designed to measure feelings of hostility, distorted attitudes toward the E (Irrational Aggression), and self-blame. A personality variable, measured by the SI discrepancy, was included to determine if this were a relevant dimension in evaluating the outcomes in the different cathartic procedures. The results were only suggestive, as there were significant differences in the same groups between the two replications. Consequently, the replications were regarded as two independent samples. The results were as follows:

1. In the first replication, the Neut.-Role Chng. control attained the greatest output in the digit symbol task, while the Cath.-Role Chng. condition demonstrated the lowest output in performance. The test of significance between the two groups in which E adopted a neutral role resulted in a higher significant output for the Cath.-Role Chng./Actl. Chng. condition.

2. In the first replication, the Ss in Cath.-Role Chng. condition attained the highest scores on the hostility subscale. The scores obtained by this group accounted for the very significant F yielded by the analysis of variance. A further examination of the data by the use of the t-test resulted in three significant comparisons between the Cath.-Role Chng. conditions and each of the remaining three groups. The IA subscale analysis resulted in a very significant F with conditions maintaining the same relative positions in mean scores.

3. In the conditions where E assumed a neutral role, an analysis of covariance resulted in a significant drop on the IA subscale in the Cath.-Role Chng. condition when hostility measures were equalized over all groups.

4. In the groups employing the actual role change procedure, those Ss classed as above the median on the SI also obtained higher scores on hostility and self-blame, demonstrating a direct rather than inverse relationship between this personality variable and the two subscales.

Microfilm $2.00; Xerox $4.00. 74 pages.

SELF-PERCEIVED VALUES: AN INDEX TO EVALUATION IN GRADUATE EDUCATION

(L. C. Card No. Mic 59-415)

Edward John Polder, Ph.D.
The Ohio State University, 1958

The general purpose of this research was to draw attention to the urgent need for educational institutions to develop methods enabling students to deal with the highly complex and rapidly accelerating social organization of modern life. More specifically, the study has been an exploratory attempt and a personal exercise in concept formation to (1) identify the pattern by which a small sample of students, admitted to candidacy for the Ph.D. degree at The Ohio State University, were able to experience qualities of personal significance from their education; (2) to identify groupings of students according to the degree to which they were able to obtain increments of value from their educational experience; and (3) to identify some of the commonalities of the university environment which tend to offer significance for students. Using an interview schedule to elicit the self-perceived values of students' education, two comprehensive dimensions, termed extension and definition, were abstracted as descriptive of the pattern of experience formation. Essentially, these dimensions correspond to the degree of structure an individual gives to new elements in his experience.

The results of this inquiry suggested the further application of these dimensions to describing students as being more or less generally open or closed to new experience and to describing the degree to which students are able to bring their experience to explicit and conscious fulfillment.

In generalizing from this preliminary study, it would seem that its method of inquiry could be extended as a general means of evaluating curricular procedures in educational situations. Such a procedure takes into consideration the student's personally obtained value as well as the social value of education. While the content and amount of significance will vary for each student relative to a given educational environment, the dimensions evolved here should generally hold as descriptive of the form by which experience is personally composed. However, subsequent research employing large-scale sampling procedures will be required for further validation of the dimensions. Through these more definitive studies, educational environments described in terms of their students' personally experienced increments of value may be compared for the degree to which they foster or obstruct student growth. Furthermore, greater specification of behavioral and situational variables related to extension and definition of experience may be discovered.

Should subsequent research in some measure validate these dimensions, it would seem that this method can offer a powerful instrument for determining the complementary growth of both individuals and the complexly organized environments in which they behave.

Microfilm $2.50; Xerox $8.80. 191 pages.

MOTOR ACTIVITY AND DEPRESSION IN JUVENILE DELINQUENTS

(L. C. Card No. Mic 58-3128)

Donald Leslie Weston, Ph.D.
Boston University Graduate School, 1958

Major Professor: Murray L. Cohen

The purpose of this study was to test certain predictions derived from a theory of juvenile delinquency. This

theory states that delinquency is related to increased motor activity. This increased motor activity is the child's defensive process against experiencing an underlying depression. This depression is caused by the actual or emotional loss of the parent figure in an early stage of development.

From the theoretical statements, developed by Dr. Irving Kaufman, the following hypotheses were derived: When the juvenile delinquent is placed under tension; (1) the level of depression is higher than when the tension does not obtain, (2) the level of motor activity is higher than when tension is reduced, and (3) the level of phantasy directed toward the environment and action is higher than when tension is reduced.

The subjects of this study were thirty consecutively adjudicated male juvenile delinquents between the ages of twelve and sixteen.

Each subject was tested in two situations; a tension situation immediately prior to the first court appearance, and a reduced tension situation, two to six weeks later when the child learned the court's disposition of his case; i.e., probation or committment.

Depression was measured by the Rorschach scores associated with depression. Survey of the literature led to the selection of six indicators. These were: (1) reduced R, (2) increased reaction time, (3) decreased C, (4) decreased M, (5) more frequent responses involving C', and (6) increased F+%. Shift in these measures in the two situations constituted the measure of depression.

Motor Activity was measured by two of the Katona matchstick problems administered randomly in the two situations. The number of sticks moved in a five minute period constituted the measure of motor activity.

Phantasy Activity was measured by an instrument using adaptations of the Rosenzweig pictures with four statements reflecting a greater and lesser extent of phantasy directed toward activity and the environment. This instrument was validated and reliability established. Scores reflected change in the amount of phantasy directed toward activity and the environment.

On the basis of the depression-delinquency theory, the following predictions were made regarding delinquents placed in a tension situation: (1) there will be greater evidence of depression than in a situation of reduced tension, (2) there will be greater motor activity than in a situation of reduced tension, and (3) there will be more phantasy directed toward activity and the environment than in a situation of reduced tension.

Examination of the depression scores showed an increase in depression in the tension situation significant at the .01 level. Examination of the motor activity scores showed an increase in activity in the tension situation significant at the .01 level. Examination of the Phantasy Activity scores indicated no significant increase in the amount of activity in phantasy.

These findings indicated that in the juvenile delinquent, an increase in depression is accompanied by an increase in motor activity. This is understood to be the result of the child's attempt to avoid the affective experience of depression through increased motor activity. These findings support the depression theory of delinquency and indicate that Kaufman's specification of the psychoanalytic theory of depression to explain the behavior of the juvenile deliquent is valid. This study did not explore other statements of this theory regarding the etiology of depression in the delinquent. Specific recommendations were made to expand the examination of this theory to aid the understanding of the functioning and the handling of tensions in the delinquent. Other theoretical explanations of these findings were offered.

Microfilm $2.00; Xerox $6.60. 138 pages.

THE EFFECT OF PRE-INSTITUTIONAL SOCIAL DEPRIVATION ON THE PERFORMANCE OF FEEBLEMINDED CHILDREN

(L. C. Card No. Mic 59-186)

Edward Frank Zigler, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Louis Moran

Sixty feebleminded children with M.A.'s of 4 to 8 years played a simple, monotonous game until satiated. The game consisted of two highly similar parts. Following satiation on Part 1 of the game, the Ss were presented Part 2 and were again allowed to play until satiated. Two conditions of reinforcement were introduced so that half of the Ss received both verbal and nonverbal support from E during Part 1 and only the attention of E during Part 2. The other half of the Ss received only E's attention during Part 1 and E's verbal and nonverbal support during Part 2. Two judges read the social histories of the Ss and rated each S on the degree of pre-institutional social deprivation.

The hypothesis was advanced that interaction with an adult and adult approval provide greater reinforcement for the responses of feebleminded Ss who have experienced a greater amount of social deprivation than for those who have experienced a lesser amount of social deprivation. Three of the four predictions derived from this hypothesis were confirmed. It was found that the more socially deprived Ss (a) spent a greater amount of time on the game; (b) made the maximum number of responses allowed by the game more frequently; and, (c) evidenced a greater increase in time spent on Part 2 of the game than on Part 1. The findings related to the fourth prediction, that the more socially deprived Ss would make a lower proportion of errors, were in the direction predicted, but failed to reach the .05 level of significance.

These results offer further support for the view that the alleged "rigid" behavior observed in feebleminded Ss may be just as reasonably attributed to a higher motivation to maintain interaction with an adult and to secure approval from him through compliance and persistence.

The assumption that there would be an increase in time spent on Part 2 of the game over Part 1 under both conditions of reinforcement received support. However, the two conditions of reinforcement produced no significant differences in (a) the increase of time spent on Part 2 over that spent on Part 1, (b) on the time spent on Part 1 alone, (c) the time spent on Part 2 alone, nor (d) on the total time spent on the game. The further assumption that institutionalized feebleminded Ss come to the experimental situation with both a positive and a negative tendency to respond was advanced to explain the increase in time spent on Part 2 compared to Part 1.

The M.A.'s of the Ss were found to be more highly related to performance than were the C.A.'s. A significant negative relationship was found between M.A. and the total time spent on the task. The hypothesis was advanced that the simplicity of the task reduced the meaningfulness of E's approval for Ss having higher M.A.'s, making such approval less effective as a reinforcer. A significant positive relationship was found between length of institutionalization and the increase in time spent on Part 2 of the game compared to Part 1. To explain this finding the view was advanced that the negative tendency to respond is a product of institutionalization.

It was found that a high percentage of the Ss had experienced considerable pre-institutional social deprivation. It was also found that the more socially deprived Ss had higher IQ's and were institutionalized at earlier ages than the less deprived Ss. The results of this study support the findings of earlier studies on rigidity in the feebleminded.

Microfilm $2.00; Xerox $6.20. 127 pages.

PSYCHOLOGY, EXPERIMENTAL

PROBABILITY DISCRIMINATION AND BINARY CHOICE LEARNING STRATEGIES IN SCHIZOPHRENICS

(L. C. Card No. Mic 58-7628)

George Riley Ashman, Ph.D.
University of Cincinnati, 1958

One major perceptual theory of probabilistic functionalism holds that the environment of the organism contains both constant and varying elements. According to this view, the organism must interpret the cause-and-effect sequences of the environment by means of probabilistic cues because of the ambiguity of many environmental signposts. In order to stabilize an environment that is in part undergoing constant change, the organism must be able to make a reasonably accurate probability estimate of events or objects from certain cues. Another theorist has elaborated this theory by adding that it is not the simple perception of event frequencies which characterizes perceptual events, but it is rather the patterns of experienced frequencies.

The view that organisms are sensitive to a large range of ecological probabilities has been substantiated by a number of so-called probability "matching" studies. These studies, involving both humans and infra-humans, have shown close correspondence between event and response probabilities.

Other studies have been more concerned with patterned probability events. Elaborate statistical theories have recently evolved, describing in mathematical terms the nature of learning binary choice patterns. They are highly predictive within a narrow class of probability studies. The Theory-of-Games model as applied to human learning behavior goes somewhat beyond the statistical theories in attempting to describe the most logical mode of responding to patterned probability events. While some of the assumptions which underlie this theory have been shown to be questionable, the model has proven useful as a theoretical framework for the analysis of patterns of response in some probability situations.

If the perception of probability events in their elemental or patterned form is an essential part of the adaptive process, then organisms manifesting extreme non-adaptive behavior might exhibit an impairment of this perceptual process. The schizophrenic human seems an ideal subject for the study of maladaptiveness, for his behavior tends to be rigid, sterotyped and poorly articulated with the demands his environment places upon him. There is presently no adequate explanation for the etiology of the loss of reality contact exhibited by the schizophrenic. And, in fact, little is known about how severe the "loss of reality contact" really is. For it is not known whether the bizarreness with which he responds to his environment is because of an inability to extract certain information from his environment necessary for adaptation, or whether he lacks the capacity to integrate the information.

This study is an attempt to apply the formulations of the perceptual theory described above to the maladapted organism. The general purpose was threefold: (1) to explore the validity of the theory of probabilistic functionalism when applied to the maladapted organism; (2) to investigate the importance of the perception of simple probabilities and the utilization of probability information into meaningful strategies for the adjustment of the organism; and (3) to examine the possibility that symptom manifestations of schizophrenia might be related to impaired perceptual functioning in the discrimination of simple or of patterned probabilities.

This investigation consisted of two discrete experiments. In Experiment 1, five groups of eight schizophrenics each were matched as nearly as possible for age, sex, intelligence and severity of symptoms and were given various binary probability tasks, ranging from 50:50 to 100:0, disguised as a problem solving task. This task consisted of matching geometric designs. On each trial the S had to choose between two types of variations as matching a key design. The probability pattern was the schedule of reinforcing the variations. Two additional groups of normal control groups were exposed to two of the patterns.

In part two of the investigation an undisguised probability task was presented using a slot machine type of apparatus. The S chose on each trial between betting on the left or right key of this machine. Five groups of schizophrenics were given a 100:0 and 50:50 binary choice pattern in varying sequences. Of primary interest was the speed with which the Ss learned the final set of probabilities. One group of Ss experienced consistency (100 R pattern) leading to randomness (50 R:50 L) then back to consistency (100 R or 100 L). A second group was similar to the first but experienced interpolated trials of an overall 50:50 pattern made up of varying subpatterns. A third major group experienced the final 100:0 pattern and preceding 50:50 pattern, but no initial pattern. Speed of final learning was compared for the various groups, and the data were analyzed for the strategies Ss employed.

Conclusions

On the basis of the results obtained in the present investigation, the following conclusions appear warranted.
1. Schizophrenics, in contrast to normals, are relatively

unable to discriminate simple probability patterns when such patterns are disguised as a problem solving task. The response patterns and event probability patterns of these Ss do not show the close degree of correspondence characteristic of normal Ss and tend more toward a pattern of randomness.

2. Differential reinforcement ratios tend to increase the response probability for schizophrenics in this situation if they are of the magnitude of eight-to-two or higher. These response probabilities show a tendency to reach an asymptote well below the frequency predicted by probability learning theory.

3. Schizophrenics do not appear able to utilize prior probability learning in responding appropriately to later patterns. They tend to perseverate to a reinforced response after the cessation of reinforcement renders the response inappropriate in terms of a different pattern of events.

4. Schizophrenics are for some reason generally unable to grasp the pattern of probability events in a continuous series to form logical modes of response. They are able to learn a 100:0 pattern about as well as normals when this pattern is not confounded with other patterns preceding it.

5. The perceptual theory of probabilistic functionalism appears to provide valuable principles for understanding the process of adaptation.

6. Schizophrenics appear less able to extract important information from their environment--important in terms of response appropriateness. Thus, the irrationality of their behavior may, to some extent, represent a faulty perception of the perceptual cue and event relationships.

Microfilm $2.00; Xerox $4.80. 95 pages.

LEARNING AND PHYSIOLOGICAL RESPONSES TO VARIOUS WORD-PICTURE COMBINATIONS

(L. C. Card No. Mic 58-7904)

Henry A. Bern, Ph.D.
Indiana University, 1958

The purpose of this study was to discover whether differences in learning and physiological responses, and relationships between the responses, could be detected as a function of different word-picture combinations. The orientation of the study was exploratory, both applied and theoretical considerations being inherent in its origin.

The problem was defined by three questions derived within the framework of a "theory of signs" based essentially upon Osgood's mediation hypothesis. Included, as one of the questions, was a physiological aspect of reinforcement suggested by an engineering-psychology paradigm.

The three questions asked were as follows:

1. Are there differences in the difficulty of learning to associate words and picture materials as a function of their intrinsic form, i.e. verbal versus pictorial?
2. Are there differences in electromyographic responses in association as a function of verbal or pictorial form?
3. Are there differences in electromyographic patterns of stimulus-response cycles as a function of knowledge of results, i.e. of confirmatory and negatory information?

The questions were investigated in a modified paired associate experiment. A sample of subjects, tested individually, was shown a filmed list of paired-associates consisting of words and pictures in the four possible stimulus-term/response-term relationships: Picture-picture, Picture-word, Word-picture, and Word-word. Subjects were told to study the pairs so that, given a stimulus term, they were to recognize the response-term which "goes" with it. Then they were shown the same pairs but arranged in the form of multiple choice items, each item consisting of a sequence of the stimulus term, four choices and the answer term. Responses were made by pressing a key to indicate recognition of the correct choice. Muscle action potentials taken from the forehead region were continuously recorded. The analyses of variance was used to test for differences in both key-press responses and electromyographic responses. The results showed that:

1. In paired association, when measured by recognition responses, pictures are more easily associated with any stimulus term (word or picture) than are words.
2. There are no significant differences in supra-orbital muscle action potential responses as a function of verbal or pictorial stimulus materials.
3. Stimulus-response patterns of muscle action potentials tend to confirm the paradigmatically originated hypothesis: MAP amplitude decreases with knowledge that a correct response has been made and rises with knowledge that an incorrect response has been made. Statistical tests of the significance of the differences in value, however, fail to achieve acceptable levels of significance.

In addition to responding to the original questions, the study pointed to the following research problems:

1. The specification and standardization of an experimental population of pictures.
2. The development of an experimental methodology for "picture learning" effects which will clearly distinguish among verbal and pictorial modes or presentation, oral and graphic means of transmission and aural and visual means of perception.
3. The development of the mediation hypotheses to include non-verbal (pictorial) signs.
4. The specification of overt and covert response differences between pictures and words arising from the theoretical implications of the mediation hypothesis.
5. The pursuit of the "error-reduction" analogy as an independent indication of reinforcement.

Microfilm $2.85; Xerox $9.80. 218 pages.

EFFECT OF RADIATION UPON ASSOCIATION OF PERIPHERAL STIMULI ALONG A SPATIAL GRADIENT

(L. C. Card No. Mic 59-152)

Richard Martin Carr, Ph.D.
The University of Texas, 1958

Supervisor: Dr. W. Lynn Brown

Twenty-four adult male rhesus monkeys were tested for the association of incidental peripheral stimuli along a horizontal-perpendicular spatial gradient. All of the

monkeys had received prior training on the association of peripheral stimuli at a horizontal-perpendicular spatial separation of six inches. The Ss were divided into three radiation groups consisting of eight normal or control Ss, eight low dose whole-body irradiates and eight high dose whole-body irradiates. Each of these three radiation groups were further divided into two subgroups of four animals. All irradiated animals had experienced whole-body exposure to a mixed source of gamma and neutron radiation approximately three and one-half years prior to the initiation of this investigation.

This study also investigated the relative degree of difficulty of discriminations based upon size, shape, color, and height and compared the degree of difficulty demonstrated by the monkey to the degree of difficulty of the four sets of stimuli as judged by humans. In addition, this study investigated the ability of the monkey to learn to reverse the peripheral discriminations.

The results of the analysis demonstrate that both the error scores during training and the responses to criterion during testing increase as a linear function of radiation dosage. The Ss establish a learning set for reversal over the initial week and three subsequent weeks of reversal, but do not do so over the individual days of testing. The generalization between the primary and peripheral discriminanda decreases as the horizontal separation between the two is increased.

The order of difficulty from most difficult to least difficult was found to be size discriminations, shape discriminations, color discriminations, and height discriminations. The comparison of the degree of difficulty in four types of discrimination exhibited by the monkeys and the judgment of degree of difficulty by humans demonstrated that both monkeys and humans find that discriminations based upon size or shape are more difficult than discriminations based on color or height. However, monkeys find size discriminations more difficult than shape discriminations while humans judge shape discriminations to be more difficult than size discriminations.

The results obtained in this investigation may be explained equally well in terms of either continuity or non-continuity theories of learning.

In terms of continuity theory, the peripherally placed stimulus were "received" by the organism with that one most proximate to the positive primary stimulus taking on a positive valence, according to a "gradient of spatial effect". Thus, the peripheral stimuli which are received by the organism during training form associations with the primary stimuli which affect subsequent performance when these same stimuli become the primary discriminanda during testing. The strength of this effect is related to the spatial separation of the stimuli during training.

In terms of non-continuity theory, the Ss select and attend only to specific aspects of the situation and only those aspects attended to at the moment become associated with the response. Therefore, as the radiation dosage is increased, there is a progressive constriction in the "scope of attention" of the monkey, and consequently, the irradiated monkey encounters difficulty in selecting those peripheral stimuli which are relevant to the solution of the problem. Microfilm $2.00; Xerox $3.80. 69 pages.

CS-US INTERVAL AS A PARAMETER IN AVOIDANCE CONDITIONING IN RATS

(L. C. Card No. Mic 58-7645)

Peter Macdonald Guthrie, Ph.D.
Brown University, 1958

The purpose of this study was to determine the relative efficacy of a 0.5-sec. CS-US interval on instrumental avoidance conditioning in rats, and to determine the shape of the CS-US interval function for intervals of 0.5, 1.0, 2.0, 3.0 and 5.0 seconds. A brief history of the experimental literature on CS-US interval effects on conditioning with human and animal Ss indicated that although studies with humans have generally shown a 0.5-sec. interval optimal, no studies with animal Ss have tested this particular interval. The history further indicated that determination of the shape of the CS-US interval function within the range of 0.5 to 5.0 sec. would have significance for current theories of learning, e.g., the Solomon and Wynne two-factor theory and Hullian theory.

In two experiments performed to make these determinations, 72, naive, albino rats were assigned to CS-US interval groups of 0.5, 1.0, 2.0, 3.0 and 5.0 sec. and to a pseudo-conditioning control group. The experimental groups were then given 100 instrumental avoidance conditioning trials with a trace conditioning procedure. The control Ss received 100 unpaired stimulations of the buzzer (CS) and the shock (US).

The apparatus was a modified Skinner box with an electrifiable grid floor and a bar at one end to serve as the manipulandum. Appropriate circuits provided for automatically timed presentation of the CS and US, measurement of the latencies of bar press responses to the CS and recording of between trials responding.

The principle measure of conditioning was a score based on the difference between experimental and control group responding to the buzzer on the final 50 trials. Analysis of these scores showed that the 0.5 sec. interval produced reliably more responding than the control condition, but that none of the longer intervals had. The analysis further showed that no reliable differences had occurred between the experimental groups. Graphs of the conditioning scores showed a U-shaped curve with maximal scores occurring at the 0.5- and 5.0-sec. intervals, and a fairly regular gradient of conditioned responding extending downward from the 0.5- to the 3.0-sec. interval, followed by a rise at the 5.0-sec. interval. Analysis of the percentages of conditioned responses made by all experimental groups showed that a relatively low order of conditioned responding had occurred, and this result was supported by the fact that no reliable decrease in the frequency of between trials responding was found between first and second halves of conditioning.

It was concluded that the results did not show that the 0.5-sec. CS-US interval was the most effective of those tested, but rather that the 0.5- and 5.0-sec. intervals were about equally effective. It was further concluded that the U-shaped curve represents a real phenomenon. Similarities between this curve and two others reported in CS-US interval studies were discussed, and the present results were related to current theories of avoidance learning. In conclusion, an hypothesis was suggested to account for the U-shaped curve, and specific tests of this hypothesis briefly described.

Microfilm $2.00; Xerox $5.20. 104 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

SELF-PACED WORK AND REST WITH VARIATIONS IN WORK-LOAD AND PRIOR TASK INFORMATION

(L. C. Card No. Mic 58-1965)

James Daniel Hitt, Jr., Ph.D.
Tulane University, 1957

Chairman: Edward A. Bilodeau

An experimental study was undertaken to determine the effect of work-load and prior task experience and information on self-pacing behavior in a simple self-paced cranking task.

The results of previous research had shown that when light and heavy loads are imposed in the manual cranking task, subjects working under the lighter load turn a greater number of revolutions per unit time, but that the two loads produce equal amounts of fatigue over a constant time interval of practice.

Other research had indicated that subjects who have previously experienced the cranking task crank at a lower initial rate than those who have had no prior practice. As practice continued, the experienced, initially slower subjects subsequently performed at a higher rate, suggesting that initial conservation enabled them to maintain a higher rate for the total practice period.

Two hundred and four Ss in the present study turned the manual crank against a light or a heavy load as rapidly as possible, working and resting ad libitum until a total of 180 sec. of cranking had accumulated.

A preliminary practice period provided some Ss with prior experience with the cranking response under both loads. Within each load, three groups were distinguished by the amount and kind of information provided by instructions and/or experience prior to the test. Ss in one group were instructed only that they must crank for a total duration of 180 sec. A second group experienced the Pretest and was informed of Test work duration. The third group had the Pretest, knew Test duration, and was also told which load would be used for the Test.

Measures were made of rate of cranking, duration of voluntary work prior to rest, and duration of rest following initial work period and over the entire cranking assignment.

The load variable resulted in a greater rate of responding under the light load during the first 5 sec. of practice, the first ad libitum work session, and the total 180-sec. practice period. There were no load differences in duration of first work period, duration of first rest, or total rest over the assignment.

The load variable results were held to indicate that Ss cranking against different work loads become equally fatigued, because the lower response rate under the heavy load constituted an adjustment to the greater increment of fatigue per heavy-load response.

The information variable results were lower rate during the first 5 sec. of practice for groups with more information, but a subsequent higher rate with concomitant increases in work and rest durations. The information results primarily discriminated between Pretested and non-Pretested groups. The slower initial rate with subsequent greater rate over the total task among Ss who had prior experience with the task was interpreted as pacing behavior by which Ss conserved themselves initially, distributed effort more evenly over the practice period, avoided excessive fatigue at any stage of practice, and ultimately produced a greater number of responses over the total practice period than Ss without prior experience who did not so pace themselves, and who initially performed at a faster rate.

Hullian conditioned inhibition theory may account for only the slower initial rate for experienced Ss. The pacing-conservation interpretation here employed is more adequate because it accounts for larger and more complex segments of behavior.

Microfilm $2.00; Xerox $3.00. 38 pages.

DETECTION OF SEPARATIONS BETWEEN ADJACENT SIGNALS ON A SIMULATED PPI RADAR SCOPE

(L. C. Card No. Mic 59-733)

Gerald Leonard Howett, Ph.D.
Columbia University, 1958

An optically simulated Plan Position Indicator (PPI) radar scope was used to evaluate the effects of five variables on the threshold signal luminance increment (ΔI) required for the detection of the separation between two adjacent rectangular signals. The independent variables were: scope face (background) luminance (I), simulated phosphorescence decay characteristics, scan rate, observer, and separation between the signals. The threshold increment, ΔI, is the difference between the threshold signal luminance and the scope face luminance.

1. All of the individual variables are of importance in determining the threshold ΔI, and most of the interactions, even of higher order, are statistically significant.

2. At a given background luminance, a decrease in the distance between signals necessitates, in general, an increase in ΔI in order for the separation to be detectable.

3. For the detection of a given separation between signals, an increase in the background luminance necessitates an increase in ΔI. However, the required contrast ($\Delta I/I$) decreases, at a decreasing rate, as the background luminance increases. The background luminance is by far the most important determinant of the threshold ΔI value; its effect is even stronger than that of the separation between the signals.

4. The course of phosphorescence decay over time, a function determined by both scan rate and phosphor characteristics, has an effect in determining the threshold ΔI values, but it is relatively small under the conditions prevailing in the present experiment.

5. A general theoretical analysis was presented relating data from experiments (such as the present one) employing continuously changing luminances to data from conventional fixed-luminance studies. Three basic types of changing-luminance experiment were analyzed: (a) a varying test patch with a fixed background; (b) a fixed test patch with a varying background; and (c) the test patch and the background both varying.

Microfilm $2.00; Xerox $4.80. 95 pages.

MUSCLE ACTION POTENTIALS DURING VERBAL CONDITIONING

(L. C. Card No. Mic 58-7922)

Neil Davis Kent, Ph.D.
Indiana University, 1958

The analysis of response acquisition by Statistical Learning Theory assumes that the reinforcing stimulus in verbal conditioning elicits responses of the same class as the key pressing behavior that is to be learned. The purpose of the present study is to investigate this assumption by continuously recording muscle action potentials from the responding effectors. Deductions were made concerning the relative amplitude of the response in the predicting and contralateral arm when predictions were correct and when they were incorrect. Three groups of subjects were given two series of 120 trials on a Humphrey's Board using a non-contingent, determinate procedure with fixed probabilities of reinforcement. In general no reliable differences among the treatment groups in tension level within trials were found. The resistance to change in response following a change in reinforcement probability observed in one group did not appear to be related to tension levels within trials. The level of muscle tension within trials was not found to be related to reinforcement schedule of probabilities or response frequency. The general prediction that the tension response to the reinforcing stimulus arising from the predicting arm when predictions are correct plus the tension response from the contralateral arm when predictions were incorrect was greater than the tension response in the predicting arm when predictions are incorrect plus the tension response in the contralateral arm when predictions are incorrect was substantiated. More specific predictions, which are components of the one cited above, were not all substantiated.

Microfilm $2.00; Xerox $5.40. 108 pages.

ANALYSIS OF TRACKING PERFORMANCE UNDER VARIED SCHEDULES OF ACHIEVEMENT INFORMATION FEEDBACK

(L. C. Card No. Mic 59-403)

Frank John Minor, Ph.D.
The Ohio State University, 1958

The special problem with which this study is concerned is to determine the effects of scheduling achievement information feedback in a simple motor skills task upon learning and performance. This experiment investigated performance in a one-dimensional compensatory tracking task. Each 1-sec. period during a trial is considered to be a response unit. If during this interval the absolute integrated error falls below a specified limit, the unit is considered as successful and indicated as such on a decade counter displayed to the subject. Successful units were accumulated on the decade counter. In terms of the theoretical framework of this experiment, each new presentation of the subject's immediate cumulative achievement level constituted a reinforcement. Schedules of reinforcement were varied between conditions.

The conditions of scheduling the cumulative achievement scores on the decade counter were the following:

Condition I. - 100 per cent Reinforcement Schedule: Reinforcement is presented following each successful response unit by the subject.

Condition II. - Fixed Ratio Schedule: Reinforcement is presented following every fifth successful response unit by the subject.

Condition III. - Fixed Interval Schedule: Reinforcement is presented following fixed time intervals of 5 sec.

Condition IV. - Variable Ratio Schedule: Reinforcement is presented following every N̄th successful response unit, where N̄ has a range between one and eight and is random with the restriction that the mean is five.

Condition V. - Variable Time Schedule: Reinforcement is presented following N̄ seconds, where N̄ has a range between one and eight and is random with the restriction that the mean is five.

Condition VI. - Control Group: No reinforcement as defined in this experiment is presented to this group.

Each of 120 subjects was randomly assigned to one of the six conditions. Each subject served in a training session consisting of ten 1-min. trials.

Upon completion of the training in Session I, a 10-min. period was allowed to elapse before a second session of seven trials was administered. In the second session, one-half of the subjects from each condition performed under a condition identical with that under which they were trained, while the remaining one-half performed without the further presence of achievement information.

During all trials, subjects wore headphones which carried white noise in order to mask auditory scoring cues which were produced by the apparatus.

Analysis of data was performed with the number of successful response units as the basic performance criterion.

The results were interpreted in terms of three major considerations: (1) the effect of the varied reinforcement schedules on level of performance, (2) the differential effect of each schedule on level of performance when reinforcement was withdrawn, and (3) the effect of extended training and also reinforcement withdrawal on each schedule exclusive of the relative level of performance.

The major determinant of level of performance in Session I appears to be the amount of reinforcement; however, in Session II scheduling as well as amount of reinforcement influences level.

When feedback was withdrawn there was no significant difference between the level of the groups which continued to receive reinforcement in the second session and their corresponding group which had reinforcement withdrawn.

Through the utilization of a multiple regression equation, differences in each condition's performance from Session I to Session II exclusive of relative level were well accounted for by predetermined hypotheses. The hypotheses, each of which significantly contributed to the explanation of the criterion variance, were the theoretical rate of responding and resistance to extinction and schedule uniformity.

In conclusion, this study suggests that as a function of scheduling reinforcement, differences in performance would occur both when there is extended training and also when reinforcement is withdrawn upon completion of initial training.

Microfilm $2.00; Xerox $3.80. 69 pages.

VISUAL VERSUS AUDITORY DISPLAYS: THE SIMULTANEOUS USE OF TWO SENSE MODALITIES

(L. C. Card No. Mic 59-406)

Robert Marion Morgan, Ph.D.
The Ohio State University, 1958

This experiment was designed to compare the visual and auditory channels, or combinations of these two channels, as means of furnishing information to an operator in a man-machine system involving a simple display-control system. Two sets of variables were studied in each of two different experiments. The two variables were level of task complexity and mode of stimulus presentation. In the first experiment the level of task complexity was varied by presenting a number stimulus to the operator which was randomly selected from a population of numbers with varying degrees of restriction. One level made use of a series of randomly selected numbers, all from numbers 1 through 4. The next level used a complexity of numbers selected from 1 through 6, and the highest level of complexity consisted of numbers selected from 1 through 8. The four modes of stimulus presentation involved a visual stimulus, an auditory stimulus, a randomly alternated visual or auditory stimulus, and the simultaneous presentation of the same stimulus number by visual and auditory channels. These involved only a single response for each stimulus presentation.

In the second experiment, which involved the presentation of two different stimulus numbers simultaneously to the operator, the level of task complexity was varied as in the first experiment. The mode of stimulus presentation involved a group which received a double visual stimulus, one which received a double auditory stimulus, and a third group which received one of the numbers visually and the other auditorily, the two being presented simultaneously.

In both experiments it was found that none of the different stimulus presentation groups differed in response time at the lowest level of stimulus complexity. In the first experiment it was found that the group which received a random alternation in the mode of stimulus input responded more slowly than the other groups at the higher levels of task complexity. The other modes of stimulus presentation did not differ in experiment one, irrespective of complexity level. In the second experiment, none of the groups differed significantly at the low level of complexity, but the visual input group was significantly faster in mean response time than the auditory or the auditory-visual group at the more complex levels. These latter two groups did not differ significantly at any of the three levels of task complexity.

It was found in both experiments that each increase in level of task complexity resulted in a concomitant increase in response time for the groups.

Microfilm $2.00; Xerox $3.00. 47 pages.

THE SECONDARY AND EXPERIMENTALLY UNCONDITIONED REINFORCING PROPERTIES OF A STIMULUS TESTED AT SEVERAL DRIVE LEVELS

(L. C. Card No. Mic 59-748)

Donald Carl Moser, Ph.D.
Columbia University, 1958

This study was planned to test the influence of different levels of drive (measured in hours of food deprivation) upon the effectiveness of a secondary reinforcer (S^r). S^r effect was tested by determining the amount of conditioning achieved when a previously unconditioned operant response, bar pressing, was reinforced only by the presentation of the S^r. Sixty male albino rats of the Wistar strain were used as subjects.

In part 1, 30 animals were divided into 5 experimental groups (N = 6), equating them on the basis of operant level responding while 22.5 hours food deprived. During operant level determinations each response produced a one second period of illumination of the experimental box by a 7.5 watt light. While maintaining the same drive conditions, the light was established as an S^r. All animals were given 200 presentations of a small drop of sucrose solution (20.1 percent, by weight) on an aperiodic schedule with a mean interval of one minute between presentations. The light was turned on one and one-half seconds before the sucrose solution was available, and remained on for two seconds after sucrose presentation. The groups were then randomly assigned to drive levels of 0, 3, 6, 12 and 22.5 hours food deprivation. Eleven days of pre-test determinations of bar pressing activity were taken under the different drive levels. During this time no experimental reinforcement was produced by bar pressing. The next three days (test) were the same as the preceding condition, except that now each bar press produced a one second period of illumination of the experimental box.

In Part 2, a second group of 30 animals was used. Five control groups (N = 6) were formed under the same matching procedure used in Part 1. The balance of the procedure of Part 1 was repeated for the control groups, with one exception. During the phase when the light was established as an S^r for the experimental animals, the light was never presented to the control animals. The light was not, therefore, an S^r for the control animals.

The training procedure employed for the 30 experimental animals did establish light onset as a positive secondary reinforcer for bar pressing. However, the numbers of responses given during test sessions by the five experimental groups, each tested at one of the five drive levels, did not differ reliably. It was concluded, therefore, that deprivation time during secondary reinforcement of a previously unreinforced operant response does not differentially influence the number of responses generated by secondary reinforcement.

The data obtained in Part 2 of this study showed, in corroboration of several other experimental findings, that the light was an unconditioned positively reinforcing stimulus. The number of responses given by the control animals on each of the three test days was significantly greater than the pre-test value. In addition, it was shown that this unconditioned reinforcing effect of light onset did not vary as a function of drive level at the time of test.

Further analysis of the data permitted several other conclusions to be drawn:

1. No relation between deprivation time and the number of responses emitted during operant level determinations was shown.
2. The unconditioned reinforcing power of illumination from a 7.5 watt light was noted when initially tested, and was temporarily increased when tested again after a lapse of time, in this case 28 days.

Microfilm $2.00; Xerox $3.00. 48 pages.

AN EXPERIMENTAL STUDY OF THE EFFECT OF ROLE BEHAVIOR ON AUTOKINETIC PHENOMENON

(L. C. Card No. Mic 58-1968)

James Harrison Lee Roach, Ph.D.
Tulane University, 1957

Chairman: E. Lee Hoffman

While the foundation for self is laid down early in life, it seems reasonable to assume that experience resulting from adult role enactment will have a decided effect on self-organization. As a result of continued occupancy of a position of authority or of operating within a highly structured authority system, it might be expected that individuals would take on certain aspects of this role and continue to play this role even in situations where such role enactment is not called for.

In the USAF each individual wears insignia which indicate, to some extent at least, what role he officially enacts. To some degree, rank and rating are associated with amount of authority. In the USAF (as in general) an individual's official role may pervade other situations and exert an influence on inter-personal relations and judgments where official role influences are not supposed to operate. It is in this frame of reference that the present study is conceived. In an ambiguous situation where command is not involved, will higher rank and rating influence judgments?

The subjects in this experiment were 48 lieutenant colonels, USAF, drawn at random from approximately five hundred of like rank enrolled in the Command and Staff School of the Air University. They were trained to perceive a certain length of movement of light and then were placed in an experimental situation where social influence could operate to change their judgments of movement. The autokinetic phenomenon was used as the vehicle.

Before the experiment a confederate was trained to enact the following five roles: rated colonel, non-rated colonel, rated major, non-rated major, and civilian. In each experimental situation the confederate gave judgments of the autokinetic phenomenon which averaged three inches below or above the norm established by the subject. The amount of shift (in inches) of the subject from his own standard toward the judgment of the confederate divided by the standard error of the difference gave a conformity score. The conformity scores were analyzed in terms of the various role situations.

Prior to the autokinetic session, subjects were trained to an eight-inch moving light and established a norm. This norm generalized as predicted to the autokinetic phenomenon. As also predicted, social influence operated to produce conformity in autokinetic judgments which remained relatively stable after social influence ceased.

The experimental design employed made it possible to determine that there was a differential effect when social influence was applied upward as compared to downward. The cause of this effect is unknown. However, the discovery of this differential effect is thought to be significant and should influence further use of this technique. Although consistent data were found to support the hypothesis that greater conformity behavior would result with higher rank and rating, the differences obtained were not statistically significant.

Microfilm $2.00; Xerox $3.00. 34 pages.

AN ANALYSIS OF RELIGIOUS COUNSELING PRACTICES OF NINE SELECTED NEGRO COLLEGES

(L. C. Card No. Mic 58-5219)

Paul Lawrence Taylor, Ed.D.
Indiana University, 1958

Supervisor: Robert H. Shaffer

Problem

The purpose of this study was to analyze religious counseling practices in the nine selected colleges which represent the three types of American colleges: (1) church-related, (2) private, and (3) publicly-controlled. Specifically, this investigation had a three-fold goal: (1) to scrutinize the religious counseling practices of the nine selected colleges, (2) to discover what these colleges are doing to fulfill these needs through their organized religious counseling program, and (3) to suggest ways and means of fulfilling the discovered needs through a religious counseling program. Therefore, this study was designed to facilitate an understanding of:

1. Aid given in the efficiency of dealing with such problems of a guidance program in Negro higher education
2. The present status of religious counseling in Negro institutions.

It is also the design of this study: (1) to provide reference for similar studies for the types of colleges selected for the survey, (2) to enable directors of guidance programs to deal with problems when they arise in the prospective, (3) to supply such information for administration of similar institutions as well as to other organizations.

Procedure

The method used in collecting the data was an Interviewer's Guide completed by the chief religious counselors during a personal interview with the investigator. The items on the instrument were divided into four classifications: (1) general information concerning the institution, (2) general information concerning the chief religious counselors, (3) general information concerning religious policies, objectives, and activities of these colleges, and (4) general functional survey of their work. The instrument was further designed not only to reveal religious counseling practice trends of the past and present, but also to reveal how counselors at these institutions felt concerning the entire guidance program in order that they may render recommendations to improve their areas in the field of guidance, how they may improve themselves, and how the entire field of guidance may improve. After the instrument was prepared and checked, a pilot study was conducted to test it for clarity, ambiguity and general reception. In selecting the institutions to be studied, catalogues of the Negro colleges having membership in the National Association of College and University Chaplains were examined. From this list, 21 were chosen initially as meeting further examination on the basis of the development of their religious counseling. The names of these institutions were submitted to the President of the National Association of College and University Chaplains who confirmed them as being particularly worthy of study. The investigator visited these schools personally for first-hand observations and remained on the campus of each school from a day and a night to two days. During this time consultations were held with the college administrators and representative faculty people, both individually and in groups at which time the Interviewer's Guide which appears in the Appendix was filled out. When the Interviewer's Guide and interviews were completed, those pertaining to administrative religious provisions and student organizations were analyzed by the investigator. Upon the completion of the tabulation, the results of these as well as of the less objective phases of the study such as the personal interviews and group consultations were interpreted.

Findings and Conclusions

(1) The range of the enrollment of the institutions in this study is from 321 to 4,073. (2) There were seven different types of religious organizations in the nine selected institutions and 56 organizations distributed among the nine. (3) Voluntary attendance was found in 77 per cent of the nine institutions of this study. (4) Trained Negro religious leaders are badly needed. (5) It is apparent that the title chaplain is most generally used to designate the chief religious counselor. (6) The nine chief religious counselors in this study have earned a total of 32 degrees, an average of 3.55 degrees per institution including four doctorate degrees. (7) Private institutions have employed the chief religious counselors with the greatest number of degrees. (8) The range of experience succeeding the first professional degree of the nine chief religious counselors is from eight years to 37 years. (9) The academic rank of the nine chief religious counselors stands high at the institutions at which they are employed. One is a dean; one is a department head; four are professors; two are associate professors and one indicated no rank. (10) The attendance of the nine chief religious counselors at the professional meetings are: five or 55 per cent of the chief religious counselors attend these meetings regularly, three or 33 per cent attend these meetings occasionally, and only one or 11 per cent did not report at all. (11) The scope of the reading of the nine chief religious counselors read 25 different journals or magazines. (12) Eight or 88 per cent of the chief religious counselors kept regular office hours; and one or 11 per cent kept no regular office hours but was available. (13) The number of hours spent per week by the nine chief religious counselors in interviews with

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

instructors, parents and students are, 19 hours, 24 hours and 75 hours respectively. (14) Seven or 77 per cent of the institutions in this study offer courses in religion, and four or 44 per cent of the institutions in this study, require courses in religion for graduation.

Microfilm $2.60; Xerox $9.00. 200 pages.

SOCIAL PSYCHOLOGY

ATTITUDES ASSOCIATED WITH LOCAL UNION LEADERSHIP

(L. C. Card No. Mic 59-402)

Robert Wilbur Miller, Ph.D.
The Ohio State University, 1958

Social - psychological determinants of union leadership have been a topic of considerable interest to students of American labor. It is reasonable to suppose that an individual's pattern of attitudes may be an influential characteristic leading to incumbency of union office. The purpose of the present study was to explore the association between local union leadership and six specific attitudes. Previous research had suggested that the attitudes were important factors in the behavior of union officials. A special concern of the study was the relative contribution to leadership of each of the attitudes.

A 50 per cent random sample of union members from a local union in the Columbus, Ohio, area and all local union presidents and secretaries from the same area were surveyed for their (1) belief in workers' opportunity for occupational mobility, (2) identification with the working class, (3) favorableness toward management, (4) trust and confidence in other people, (5) personal striving, and (6) "F score." With the exception of "F," all variables were scaled by the standard Thurstone method. A shortened version of the "F - Scale of Authoritarian Personality" provided the measure of "F." Questionnaires and follow-up letters were mailed to the subjects. Respondents from the local union totaled 134, or 23 per cent of the members selected for study. Fifty-five, or 30 per cent, of the local union presidents and secretaries returned their questionnaires.

One of the findings of the study was an indication of the extent to which the union presidents and secretaries manifested the attitudes under investigation. Means of the scaled-attitudes for this group showed that they possessed considerable belief in chances for occupational mobility, were midway between favorableness and unfavorableness toward management, tended to moderately high identification with the working class, had substantial trust and confidence in other people, were strong personal strivers, and were moderately low F. Correlational analysis provided additional findings concerning the association of leadership and attitudes. For purposes of correlation, leadership was made a dichotomous variable; the sample of local union presidents and secretaries was designated the leadership group, and the sample of local union members, the rank-and-file group. Small but significant correlations indicated that the leaders differed from the rank and file by showing greater belief in workers' opportunity for mobility, greater trust in others, and lower F. Leaders also evidenced trends toward greater personal striving and less favorable perception of management. There was no indication that leaders differed from non-leaders in working-class identification. Analysis of the respondents' personal backgrounds showed the leadership group to be significantly better educated than the rank and file group. Leaders were also significantly older than non-leaders. Multiple correlation indicated that age and education, in that order, were most important in explaining local union leadership. Of the attitudes, belief in opportunity for mobility contributed most to leadership.

The results suggested that the local union leaders possessed a pronounced tendency toward personal superiority. They were not only better educated than rank-and-file members, but also manifested attitudes indicative of greater personal "adjustment," optimism, and desire for achievement. An additional suggestion from the data was that leaders seemed to experience a degree of attitudinal conflict. They not only possessed considerable belief in workers' opportunity for mobility but also evidenced substantial identification with the working class. Leaders thus endorsed the notion of an "open society" and at the same time expressed a belief that workers are a separate class and need to maximize their collective interests. This ambivalence may represent a basic conflict within the American labor movement itself.

Microfilm $2.00; Xerox $3.80. 68 pages.

AN INVESTIGATION OF SOME FACTORS IN PARENT-CHILD SIMILARITY IN SOCIAL ATTITUDES

(L. C. Card No. Mic 59-176)

David Edward Proctor, Ph.D.
The University of Texas, 1958

Supervisor: Dr. Wayne Holtzman

Most of the research on the role of the parents in the development of a child's social attitudes has concentrated on the problem of the existence of or the magnitude of correspondence in social attitudes. The available data from these previous studies strongly support the conclusion that there exists a low but positive degree of similarity between parent and child. It is primarily the personality of the parent as a factor in the communication of social attitudes which is of central importance in the present study. Dogmatism and over-possessiveness were selected as the parental personality characteristics to be investigated. Besides the personality of the parents, the grade level and the sex of the child were considered independent variables.

The following hypotheses were made:

1. Similarity will increase with increasing parental dogmatism.
2. At the high end of the dogmatism continuum there will be greater variability of similarity.
3. Similarity will increase with increasing parental over-possessiveness.
4. At the high end of the over-possessiveness continuum there will be greater variability of similarity.
5. Similarity will decrease with the grade level of the child.
6. Similarity will be greater between father and son than between father and daughter.
7. Similarity will be greater between mother and daughter than between mother and son.

Several points were made in regard to the inadequacy of the widely used correlation coefficient as a general index of similarity. A distance measure of similarity was used in the present study.

From a large pool of social attitude items a final group of six clusters, each containing fifteen items, were selected from the items judged to be most appropriate. The six clusters contained items covering attitudes toward society, education, youth, church, conservatism and child rearing. In addition, the parental form contained Rokeach's Dogmatism Scale and an Over-Possessiveness Scale based on Schaefer and Bell's work.

222 children in the eighth, tenth and twelfth grades were given the questionnaire. The final sample contained a total of 66 middle-class families with data on both parents and at least one child in each family.

None of the hypotheses as general principles was confirmed. With regard to the two characteristics of the parent's personality all but the fourth hypothesis were regarded as unconfirmed with no qualifications. There was some evidence suggesting that dogmatism in the fathers and over-possessiveness in the mothers may be factors associated with lesser rather than greater similarity. The fourth hypothesis received support only in the mother-child analyses. Significantly greater variability in similarity was found in the group of highly over-possessive mothers for three of the distance measures. The possibility was discussed that some artifacts due to response set were present and may have complicated the interpretation of the results concerning dogmatism and over-possessiveness.

The data not only failed to support the grade- or age-trend hypothesis, but were sufficiently clear and consistent to suggest strongly the opposite hypothesis. With increasing grade level significant increases in similarity to the fathers were found in four distance measures. For the mother-child measures of similarity only one measure was found to increase significantly. The contrast of an increase of four measures of similarity in the father-child data but only one increase in the mother-child data was explored further, but the differences in the trends were not statistically significant. This analysis did reveal that the children were significantly more similar to their mothers in attitudes toward church.

Although the hypotheses were not confirmed, the more general thesis that the personality of the parent may be associated with similarity of social attitudes received very tentative support. Of more importance because of its greater consistency from one sphere of attitudes to another is the grade-trend of increasing similarity to the parents.

Microfilm $2.00; Xerox $7.00. 150 pages.

SOCIOLOGY, GENERAL

LEVELS OF ASPIRATION AND OTHER-DIRECTION

(L. C. Card No. Mic 59-365)

Mary Jane Cramer, Ph.D.
The Ohio State University, 1958

The tradition of competitive striving for economic success is said to be currently challenged by a new concept of the value of personalized social relations which has the unintentional effect of modifying the aspirations of higher status youth, who until now have been assumed to be the most involved in competitive achievement norms. These new values in interpersonal relations are believed by David Riesman to result in an intense preoccupation with peer group approval and a consequent de-emphasis on long range plans for the future. The purpose of this study was to determine whether this "other-direction," as Riesman has termed it, is related to the level of aspiration of college students and whether this relationship is affected by variations in background assumed to be connected with the new values placed on personalized social relations.

The subjects in the study were 589 male college students enrolled in the Colleges of Commerce, Arts, and Engineering at The Ohio State University. Level of aspiration was defined as a combination of two variables: expectations for high goals and a strong career orientation. Four types of aspirers were derived from a cross-classification of these two dimensions. Background factors included the occupational orientation of the student, social status, urban and non-urban residence, religious affiliation, and the attendance at college at the normal college age. Other-direction was measured by a modification of the Bell ID-OD Inventory.

Although differences in other-direction among levels of aspiration were usually small, the frequency with which higher other-direction scores were associated with the lower levels of aspiration suggests that there was present among students in this sample a slight undercurrent of conformity and need for personalized response related to a lower level of aspiration. High aspirers, regardless of

differences in background, appeared to share more similar views regarding other-direction than the lower aspirers, although they were not always the most individualistic students, suggesting that the stereotype of the goal-driven, individualistic striver may be an inappropriate description of the high aspirers in the younger generation.

The highest other-direction means did not always appear in connection with background factors assumed to be connected with experience emphasizing the newer values of personalized social relations. In this study, training for a business career, a middle rather than an upper-middle status position, life-long residence in a non-urban setting, attendance at college directly from high school, and affiliation with a non-traditional religion characterized the most other-directed low aspirers. Older college students, engineers, urban and upper-middle status students, and students affiliated with a traditional religion showed a much less marked tendency to associate other-direction with lowered aspiration.

It was suggested that shifts away from competitive economic achievement as a major value toward values associated with family and community may help to explain the greater degree of variability in response among the low aspirers in this study.

Microfilm $2.00; Xerox $6.40. 135 pages.

THE STANDARDIZATION OF A LEVEL OF LIVING SCALE

(L. C. Card No. Mic 59-120)

Robert Allen Danley, Ph.D.
Cornell University, 1958

A thirteen-item level of living scale was developed and standardized upon a ten per cent area-probability sample of the rural (including non-farm and farm) population of Broome County, New York, in 1955. A shorter nine-item scale was then derived, and its utility was tested upon a second ten per cent area-probability sample of the rural farm population of Cattaraugus County, New York, in 1956.

An original battery of forty-eight items consisted of items of proven validity from other scales, some items which were modified to conform to today's market, and some items which were thought to be reflective of contemporary consumer patterns. Three thirteen-item scales were standardized by reference to two different criteria: 1) internal and 2) external; the latter were a) educational attainment and b) occupational status. The three scales were tested against formal social participation, and the one standardized against occupational status was selected as having the most utility.

Nine of the thirteen items were chosen to constitute a Short Scale. This was compared with the thirteen-item scale and found to be correlated to the degree of .94.

The nine-item scale was used in a study of low-income farmers in a second county. The scale's predictive power was demonstrated by its ability to separate the sample into level of living categories which were meaningfully related to several important sociological variables. Age and sex were found to affect certain of these relationships.

Literature cited 1) substantiates the importance of the concepts of level of living and socio-economic status and 2) reviews the development of instruments to measure these concepts as defined objectively.

Microfilm $2.00; Xerox $6.40. 132 pages.

STAFF PARTICIPATION IN A MENTAL HOSPITAL

(L. C. Card No. Mic 59-394)

Mark Lefton, Ph.D.
The Ohio State University, 1958

This study reports on the relationship between the degree of perceived decision-making influence of all professional personnel in a relatively small, short-term, intensive-therapy mental hospital and their evaluations of the status and competence of staff members, their estimates of job satisfaction, their congruence or lack of it in rating the behavior and functioning of specific patients, and their evaluations with respect to the efficacy and suitability of particular types of therapies.

The hypothesized relationships between these variables were predicated upon the assumption that the situational features intrinsically characteristic of each of the five hospital wards were the crucial determinants of real and perceived staff relationships and functioning.

Each of 53 professional staff members (5 ward administrators, 15 psychiatric residents, 5 clinical psychologists, 5 social workers, 18 registered psychiatric nurses, 5 occupational therapists) was asked to estimate his perceived and ideal decision-making influence, status and competence evaluations, degree of job satisfaction and ratings of treatment efficacy on a relatively new type of recording instrument. This instrument is a magnetic board, and the raters merely place magnets on it in accordance with their responses. The board contains one rating scale ranging from 0-100 and permits quantitative comparisons of responses. Staff congruence regarding the functioning of patients was measured by the Lorr Psychiatric Rating Scale. This scale contains 62 items which require specific judgments about particular aspects of the behavior of the patient rated and is currently used for diagnostic purposes at other psychiatric institutions.

The major findings can be summarized as follows: (1) The degree of perceived relative influence in the decision-making process was highly associated with professional group membership and inversely with the profession's relative position within the objective authority system. (2) Although the influence of professional group membership was exerted across the five hospital wards, it was found that the degree to which such influence was actually manifested in terms of the analytic variables varied perceptibly from ward to ward and in accordance with very specific features which differentiated these units from one another (e.g., the extent to which organic-type treatment methods were employed). (3) A positive relationship was found between the degree of perceived decision-making influence and the magnitude of preferred status differentials between all professional groups. (4) A positive relationship was found between the degree of perceived decision-making influence and agreement with specific therapists in their descriptions of patient behavior. (5) All respondents, regardless of profession or ward assignment, rated the non-organic treatment methods as more effective than any of the organic types.

The findings with respect to the importance of professional group membership as a determinant of staff member participation in the ongoing processes of the mental hospital are consistent with the findings of previous investigations in this area. The significance of this study, however, lies in its illumination of the crucial importance of specific situational factors associated with actually operating clinical settings which serve to affect the functioning and relationships of mental health specialists.

Microfilm $2.00; Xerox $6.20. 129 pages.

MIGRATION AND COMMUNICATIVE INTEGRATION IN A RURAL FRINGE POPULATION

(L. C. Card No. Mic 59-409)

Saad Zaghloul Nagi, Ph.D.
The Ohio State University, 1958

The purpose of this study is to determine the degree of communicative integration among old residents and among in-migrants, as well as between the two segments, in the population of the rural fringe of Columbus, Ohio. Another objective of the study is to investigate the relationship between certain factors identified by this study and the degree of communicative integration of migrants in their rural fringe communities of residence. These factors are sex, women's work outside the home, farm and non-farm occupations, non-farm occupational levels, education, the number of children of school age at home, the degree of stability-mobility, the length of residence, and the degree of integration in previous communities of residence.

An index of communicative integration is devised on the basis of both formal and informal social participation scores. Migrants are defined as those who moved to the rural fringe during or after 1946. The rural fringe is defined as the area falling within the standard metropolitan area, but outside the urbanized area, excluding all the incorporated places and the unincorporated places if 50 per cent or more of their already built houses are not adjacent to farmland or woodland.

An area sample constituting 25 per cent of the total rural fringe area and a population sample composed of 25 per cent of the household heads residing in this sample area were selected. This sample yielded 303 completed interview schedules.

Old residents showed a significantly higher degree of integration in their communities of residence than the migrants. The migrants' integration scores in communities other than those of residence are significantly higher. Both the old residents and the migrants showed a significant tendency to choose their friends from within their respective groups. Among the migrants, women were slightly more integrated than men, and non-working women more than working women. Farmers were better integrated than persons in non-farm occupations. Both the occupational and educational levels of the migrants were significantly and positively correlated with their degree of integration. These two variables showed also a curvilinear relationship to integration. The number of children at home and the length of residence were found to be positively associated with integration. The degree of integration of migrants in their present communities of residence also was found to be correlated positively with the degree of their stability and negatively with the degree of their integration in the previous communities of residence.

Several conclusions may be drawn from this study. Attempts to study communicative integration should take into consideration both the formal and informal aspects of social identifications. Old residents in the rural fringe communities are more local bound in their social relationships than the migrants. The relationship between the two segments exhibits symptoms of conflict. The process of integration in a new community of residence is largely a process of shifting the social identifications from the old community of residence to the new one. Other conclusions may be drawn from the tests of the specific hypotheses.

Microfilm $2.00; Xerox $5.40. 109 pages.

COMMUNICATION AND SOCIAL CHANGE IN RURAL INDIA

(L. C. Card No. Mic 59-744)

Baidya Nath Varma, Ph.D.
Columbia University, 1958

This dissertation explores the possibility of applying communications theory in studying rural Indian society. First, the role of the mass media in the dissemination of information and propaganda in rural India is examined. Then an analysis of the social structure of the Indian village, family, caste and the state is presented as a background for investigating some problems of change. These problems relate to the impact of new ideas and information on the stratification system of rural India. As a means of clarifying the nature of some of these problems, about a dozen published field studies of Indian villages were reanalyzed. Finally, the social structure and the communication process of a North Indian village was examined in order to determine the pattern of change in this particular village.

The data on this Indian village was gathered by a team of social scientists from Cornell University over a period of a decade, i.e., 1947-1957. The author analyzed the data on the process of communication and the impact of new ideas on the residents of this village. Statistical methods were used to show the changes in people's political attitudes as a consequence of their exposure to the mass media and interpersonal channels of communication.

It was found that the villagers of India were coming increasingly under the influence of the secular ideas emanating from the cities and brought to the villages through governmental and other agencies of communication. The traditional types of outside contact of the Indian villages (e.g., visiting of kin members and people who perform special services, barter and trade, temporary migration for employment, pilgrimage, etc.) were now being supplemented more and more by the visits of government officials, social preachers and political propagandists. As a result, there was a new consciousness in the villager of his rights and duties given to him by the Indian constitution.

The villager now sees the possibility of raising, through individual or group effort, his social status, which had been fixed rigidly by the caste system. There is a strong evidence of non-caste-oriented action in the political sphere

but caste-oriented action in the social and economic sphere of village life. It appears that when a person of lower caste wants to raise his prestige in the village community, he works to improve the prestige of his caste, but when he wants to obtain his political and economic rights, he joins the "have-nots" as well as the revolutionaries and the renegades of the rural elites, who are mostly members of the higher castes. This creates paradoxes for the stratification system of the village, because the traditional canons of the caste system no longer guide the over-all behavior of the people. It was observed that in some instances the paradox was partly resolved by giving personal esteem to such individuals of lower caste who had acquired a high position in the political hierarchy, but withholding equivalent social prestige from them which would have meant a re-evaluation of the position of all their caste brethren.

It was found that the studies of Indian village communities could be enriched if the "communications" point-of-view were taken into account by the field researchers. The reanalysis of the published village studies showed that most of the authors failed to adequately place the village in the context of the nation, and in particular to observe and report the many outside influences impinging on the village, which are critical in the process of change in rural India.

Microfilm $3.85; Xerox $13.00. 298 pages.

SOCIOLOGY, PUBLIC WELFARE

COMPARATIVE STUDY OF TWO TYPES OF PAROLE VIOLATORS

(L. C. Card No. Mic 59-355)

Badr-El-Din Mohamed Ali, Ph.D.
The Ohio State University, 1958

While there have been many significant studies dealing with success or failure on parole, none have dealt specifically with the difference between two types of parole failures; namely, those who violate the regulations of parole (technical violators) and those who commit a new crime (criminal violators). The present study is the first to attempt to differentiate between the two sets of parole violators in regard to social background and personality.

This study is based upon a sample of one hundred inmates returned to Ohio Penitentiary as parole violators. Fifty of these men violated the technical rules of parole, and fifty committed a new crime. The sample was consecutive of all those returned to the penitentiary as parole violators during a six-month period.

To gather information on social background, two schedules were constructed: one of information from the prisoner's case folder and the other an interview schedule. To examine personality aspects, two interview schedules were administered. One dealt with self-concepts of parolees, and the other contained items on delinquency vulnerability. The null hypothesis in this study was that the items on social background, delinquency proneness, and self-concept would not discriminate between the two groups of parole violators.

The two types of parole violators were compared on 44 social background items, most of which were taken from the significant items of six major previous studies on parole outcome. According to the chi square test of significance, 13 (30 per cent) of the 44 items discriminated between the two types of violators beyond the .05 level of confidence. In this respect, the null hypothesis can be rejected.

Of the 13 significant background items, 7 lean in a favorable direction for the technical parole violator, 3 appear to be unfavorable to him, and 2 could not be evaluated in either direction. Accordingly, criminologists and parole administrators might be justified in assuming that the technical violator is slightly better human material, from the standpoint of background, than is the criminal violator.

On the basis of an efficiently discriminating delinquency proneness scale, namely, the De scale of the California Psychological Inventory, developed by Dr. Harrison G. Gough, the technical and criminal violators were not differentiated. Here the null hypothesis is sustained.

Tested by 30 self-concept items, the technical and criminal parole violators were distinguishable beyond the .05 level of significance on 12 items, or 40 per cent of them. To this extent the null hypothesis is rejected. It was noticed that in most of the 12 items the more naive, frank, and less sophisticated response was made by the technical violator, while the more cautious and sophisticated answer was made by the criminal violator. It seems as though the technical violator puts up less defense than the criminal violator.

While this study is not predictive in nature, its findings may facilitate future predictive studies. Some of the significantly differentiating social background and self-concept items may be utilized as basic components of a "predictive index" for forecasting the probable type of violation by parolees regarded as poor risks.

It seems that the background factors and self-concept items are complementary. Theoretically, the self-concept may be interpreted as an internalization of growth and experience in social milieu. Further studies in crime and delinquency may be able to reveal more clearly the relationships between social backgrounds and self-concepts of offenders.

Finally, it is understood that the present study is merely exploratory. Because of the small size of the sample investigated and the particular nature of its subjects, all conclusions given are preliminary and specific. Additional studies need to be made on this problem for further confirmation. Microfilm $2.00; Xerox $6.80. 145 pages.

SOCIOLOGY, RACE QUESTION

STATUS-STRIVING, SOCIAL MOBILITY, AND PREJUDICE

(L. C. Card No. Mic 59-423)

Fred B. Silberstein, Ph.D.
The Ohio State University, 1958

The purposes of the dissertation were (1) to replicate the two major studies relating vertical mobility to

ethnic-group prejudice, in the hope of casting further light on the consistency and stability of the findings, and (2) to introduce a means of measuring status-orientations in order to make possible a sharper analysis of the relation of mobility to prejudice. Thus, in the view of the dissertation, it was not mobility per se which was crucial, but the status meaning that the individual assigned to the fact of upward and downward mobility.

The two studies replicated posed some serious interpretive problems. In the first place, though not strictly comparable in method, they yielded results that were not consistent; for example, one study found that the upward mobile group was the most prejudiced, whereas the other study found that the upward mobile group was the most tolerant. In neither replication were the results produced consistent with the original studies. In the second place, both of these studies invoked the "mobility assumption." This "mobility explanation," which has recently become a popular vehicle of analysis for diverse phenomena, assumes that the climbing motives are so universal throughout our society that their direct investigation is unnecessary. This mobility assumption was called into question in the present dissertation.

In the light of these considerations a scale to measure status motivation, the mobility-achievement orientation scale, was constructed. This scale measures the place of mobility interests in a person's hierarchy of values. Thus a person was asked to compare the value he placed on mobility with other values, such as friendship and family. The final scale had good reliability, and it showed promise of sufficient validity.

The hypotheses tested were as follows: (1) Mobility per se was not expected to lead to a stable and consistent relationship with prejudice. (2) Mobility-achievement orientation per se was expected to be related to prejudice. (3) Although mobility per se was not expected to be related to prejudice, mobility in interaction with mobility-orientation was expected to be related to prejudice. For example, it was predicted that downward mobility under conditions of high orientation would yield a significantly high prejudice relative to other mobility types (e.g., the stationary or "no mobility" group). (4) Although the three hypotheses above contained the central aspect of the dissertation, an attempt was made to test the theory that prejudice is a function of the following four variables: mobility, mobility-orientation, subjective class identification, and the perception of the prejudice-norms of the respondent's reference group.

The study was carried out in Morgantown, West Virginia, and the obtained sample included, for the most part, 665 white, adult, Protestant heads of families.

The findings were rather strongly supportive of the first three hypotheses, and the fourth hypothesis or theory received some mixed support. Also, it was demonstrated that the experimental results could not have been due to a failure to control the following hidden third variables: age, income, subjective class identification, and education.

The goals of the dissertation were to add clarification to the problem of the relationship between vertical mobility and ethnic-group prejudice, and to make a contribution to the social psychology of status-striving. The study offered a variety of evidence to demonstrate, to some degree, that its general goals had been attained.

Microfilm $2.85; Xerox $9.80. 220 pages.

THE THEATER IN SPAIN SINCE 1939

(L. C. Card No. Mic 59-164)

George Lawrence Holcomb, Ph.D.
The University of Texas, 1958

Supervisor: Ramón Martínez-López

Spain is one of the few nations of the world with a truly great dramatic tradition. Since the end of the Spanish Civil War in 1939 the theater has functioned under a mild form of government censorship. The purpose of this study is to determine what has happened to the theater during this period. What is left of the prewar theater? What important new developments have taken place? What are the trends? What is the outlook for the future?

An extensive discussion of the prewar theater is followed by a treatment of four transition dramatists and six new writers who seem to be most representative of the new trends in the Spanish theater. Sources of material include individual plays of the authors selected, books and articles of general literary criticism, and reviews which have appeared in leading Spanish magazines and newspapers. This latter source adds a kind of spontaneous reaction to the more studied critiques which appear later in more formal articles.

Despite constant attacks on his realistic theater, Jacinto Benavente was still Spain's leading dramatist when the civil war began in 1936. Jacinto Grau, Miguel de Unamuno, Ramón del Valle-Inclán and Azorín, among others, had failed to stem the Benavente tide. Federico García Lorca and Alejandro Casona appeared to offer some hope for a change, but the war removed both of these promising dramatists from the Spanish scene. José María Pemán, with his traditional theater, and Enrique Jardiel Poncela, with a new type of comic theater, began to attract large followings shortly before the war. In recent years Pemán has cultivated almost exclusively the costumbrista theater.

Benavente continued to write until his death in 1954. He never changed his theater and he never lost his public. His influence is to be noted in many present-day dramatists, including Víctor Ruiz Iriarte, José López Rubio, and Joaquín Calvo Sotelo. The latter is closest to Benavente in technique and in the selection of themes, but most of his better plays contain strong political or religious elements. Ruiz Iriarte and López Rubio have followed Casona and have had their greatest successes in the teatro de evasión.

The first really important new development in the Spanish postwar theater was the introduction of a new type of comic theater. Modifying the techniques of Jardiel Poncela, Miguel Mihura and others of the new school of comic writers have created a theater in which the humor derives from

the fact that seemingly illogical, ambiguous, and often absurd thoughts, speech, and actions turn out to be perfectly logical. Furthermore the plays of Mihura, like the picaresque novels of the Golden Age, usually have a moral lesson subtly concealed beneath the seemingly absurd and meaningless story.

A second important postwar development has been the resurgence of serious drama in the form of a tragic portrayal of human existence. In this theater ordinary people, caught in the web of everyday living--with themselves or with others--find no escape from the tragedy of existence and no happiness in contemplating the future. Antonio Buero Vallejo and Alfonso Sastre, the leading exponents of this new type of theater in Spain, are modern in their techniques but their best works reflect clearly the influence of Unamuno and García Lorca.

The Spanish theater is very much alive today. Several new playhouses have opened in Madrid in recent years. The government is subsidizing three theaters. Interest in foreign plays is high, and experimental groups are active throughout Spain. On the other hand the theater does not have that freedom which it must have to develop and to perform its role properly, and until it does, it cannot be expected to regain its former high position.

Microfilm $4.00; Xerox $13.60. 312 pages.

THE DEVELOPMENT OF A GRADUATE ACHIEVEMENT TEST IN THEATRE

(L. C. Card No. Mic 59-387)

Bill G. Hulsopple, Ph.D.
The Ohio State University, 1958

This study was designed to develop a graduate achievement test based on theatre vocabulary that would satisfactorily estimate the background of graduate theatre students. Theatre background in this study was interpreted as training and experience. The general methodology consisted of (1) a selection of test materials from which the vocabulary entries could be extracted, together with the establishment of a master list of words and terms, (2) a method of prevalidating those words and terms used in test item construction, (3) the establishment of a criterion based on background training and experience in theatre, (4) the construction and administration of the test, and (5) an analysis of the results of the test.

A group of 41 theatre experts from different universities and geographical areas selected 13 basic books from which the words, terms, etc., of the master list were extracted. The pre-validation of these entries was accomplished through (1) a record of the entry's frequency in the literature examined, (2) a record of the number of sources in which the entry occurred, (3) the establishment of two familiarity indexes--one for graduate theatre students, the other for graduate students not in the field of theatre, and (4) standards regarding the differences between graduate theatre student familiarity and the familiarity of those graduate students outside the field of theatre.

The test included 11 main sub-areas of theatre which were represented by the 13 sources selected by the experts. These sub-areas were further substantiated by analyzing the course offerings in 38 universities which offered graduate degrees in theatre. The universities included represented different geographical areas.

The test was administered to 39 graduate students. Twenty-six were graduate theatre students, while 13 were general graduate students who had expressed an interest in theatre.

It was observed that the testees were able to complete approximately three items a minute. This indicated that despite its length and comprehensive coverage, the test was an efficient measuring instrument.

The results of the test produced a validity coefficient of .86 for the total test. The validity coefficients for the major divisions of (1) stagecraft and production and (2) theatrical literature and history were .86 and .77 respectively. The item-criterion correlations indicated that 51 per cent of the items were significant at the 5 per cent level of confidence. The test was not highly skewed either negatively or positively, with 63.33 per cent of the items falling within a difficulty range of .30 to .70.

The combined-halves reliability of the total test was .97. The combined-halves reliability for each of the major divisions of the test was .95.

The conclusion drawn from this study is that it is possible to estimate satisfactorily the background of graduate theatre students by using an achievement test based on theatre vocabulary.

Microfilm $2.65; Xerox $9.20. 203 pages.

MASKING TECHNIQUE IN CLINICAL PURE-TONE AUDIOMETRY

(L. C. Card No. Mic 59-288)

Milton Albert Valentine, Ph.D.
Stanford University, 1958

This study was conceived in an attempt to obtain information about the use of masking in clinical, voluntary, pure-tone audiometry. The literature on masking was reviewed and analyzed. Four previously unanswered questions were studied: (1) Under what conditions of intensity and frequency does the ear not under test begin to take part in the testing? (2) Under what conditions will various masking stimuli affect the ear opposite that to which they are applied? (3) What are the effects of various maskers on the reliability and "validity" of thresholds measured on the ear opposite that receiving masking? (4) What procedure should be followed in the application of masking?

Sixty-six subjects, thirty-four normal-hearing subjects (with packed ears to simulate unilateral hearing loss for a portion of the study) and thirty-two hard-of-hearing subjects, were tested with air- and bone- conduction stimuli using modified clinical equipment. Cross-hearing of the signal tones of 500, 1000, 2000, 3000, and 4000 cps was measured by three methods: subject's reports of lateralization, "shadow curves," and Bekesy's method of beats. Results obtained by the three methods were compared. Cross-hearing of masking was studied by observing the least intensity of masking needed to elevate the contralateral threshold for a given signal, and by observing the threshold elevations following the contralateral introduction of masking intensities of 20, 40, 60, 75, and 85 db.

Maskers studied were "white," "saw-tooth," and "line"

noises, and matched pure tones. A "rule-of-thumb" formula was derived and compared with individual "probing" and set intensity methods of applying masking. Some subjects showed anomalous responses to contralateral masking and a supplementary observation on training effects with contralateral masking was made.

Data were treated by the analysis of variance and F-test techniques. Reliability of various masking methods and stimuli was determined from test-retest audiograms under various conditions. "Validity" of various masking methods and stimuli was estimated by comparing the bone-conduction audiograms of normal-hearing subjects made with and without masking delivered to the ear not under test.

The following general conclusions were drawn:

1. Signal tones seem to be generally cross-heard at intensities of the order of magnitude of 40 db by air conduction and 15 db by bone conduction, but there is individual variation in this respect.
2. Neither subjective lateralization nor "shadow curves" can be wholly trusted as indicators of contralateral hearing.
3. Masking at intensities of 75 db or above may affect the threshold of the opposite ear, but there is great individual variation in this respect.
4. Some subjects showed elevation of the threshold of the ear opposite that receiving masking at any masking intensity, and for a few of these the effect could be reduced or eliminated by practice.
5. Of the maskers studied "white" noise seemed the most useful and least confusing, followed by "saw-tooth" noise, "line" noise, and matched tone, in order.
6. The same hierarchy was repeated in measurements of "validity" and reliability.
7. The test situation in contralateral masking seemed to resemble the signal-in-noise listening situation rather than simple threshold determination.
8. The "probing" method was found to give the most valid and reliable results, the formula was somewhat less acceptable, and the set intensity methods were found generally unacceptable.
9. Quite probably, valid threshold audiograms, even with masking, cannot be obtained on certain subjects.
10. Calibration of masking stimuli on commercial audiometers is imperative.

Microfilm $2.00; Xerox $6.40. 135 pages.

EVALUATION OF ONE- AND TWO-FREQUENCY AUDIOMETRIC SCREENING OF SCHOOL CHILDREN

(L. C. Card No. Mic 59-289)

Ira M. Ventry, Ph.D.
Stanford University, 1958

The study was undertaken to evaluate one- and two-frequency audiometric screening as a device to be employed in public school hearing conservation programs. The study had four basic objectives: (1) to evaluate the validity of the concept upon which one-frequency screening is based; (2) to evaluate one- and two-frequency screening as an individual test; (3) to evaluate one- and two-frequency screening as a group procedure; and (4) to evaluate the various advantages associated with one- and two-frequency screening.

A total of 1,517 Oakland, California public school children from grades one, three, and five participated in the study. Each subject received a modified Johnston Group Pure-Tone Screening Test and an individual sweep test. The data at 2000 and 4000 cps were drawn from the results of the group and sweep tests and were compared with the results of the full sweep test. The reliability of one- and two-frequency screening was determined by retesting, at 2000 and 4000 cps, 457 subjects (456 subjects were retested for the determination of group reliability) distributed approximately equally among the three grades. The first grade data were treated separately whereas the third and fifth grade results were combined for statistical analysis. In order to evaluate the concept that the hearing loss at 4000 cps is greater than the loss at any other frequency, pure-tone air-conduction threshold tests were administered at five frequencies to every fourth subject failing the sweep test. The results on sixty-two subjects (ninety ears) were subjected to analysis. The practical aspects as well as the efficiency of one- and two-frequency screening were discussed.

The results of the analyses of variance between mean threshold losses from 500 through 8000 cps indicated that there are significant differences between these mean threshold losses. The F test for testing the difference between correlated means indicated that the mean threshold loss at 4000 cps is significantly greater (P's ranging from $<.05$ to $<.001$) than the mean threshold loss at any other frequency tested. The results of the comparisons between the one- and two-frequency tests and the sweep test as well as the reliability of the one- and two-frequency tests are summarized in Table 1.

TABLE 1

SUMMARY OF THE RESULTS OF THE EVALUATION OF ONE- AND TWO-FREQUENCY SCREENING

Grade	Type of Test	Frequencies Tested	Chi Square Between Criterion and Test	Relationship Between Criterion and Test	Reliability of Test	Chi Square Between One- and Two-Frequency Tests	Relationship Between One- and Two-Frequency Tests
First Grade Results	Individual	4000 cps	14.00[a]	.669[b]	.86	6.00	.688
		2000 and 4000 cps	6.13	.686	.84		
	Group	4000 cps	18.45	.84	.79	6.00	.685
		2000 and 4000 cps	13.00	.87	.80		
Combined Third and Fifth Grade Results	Individual	4000 cps	28.00	.666	.93	9.17	.688
		2000 and 4000 cps	14.06	.684	.95		
	Group	4000 cps	31.93	.84	.86	23.00	.663
		2000 and 4000 cps	12.46	.84	.90		

[a] A chi square of 3.84 is significant at the .05 level; 6.64 at the .01 level; and a chi square of 10.83 is significant at the .001 level (1 df).

[b] The upper limit of the contingency coefficients (reported to three decimals) employed in this study is .707. The upper limit of the tetrachoric correlation coefficients (reported to two decimals) is 1.00.

On the basis of these results the following conclusions can be drawn: (1) the most adequate test on the first grade level is the two-frequency individual test. The group tests have inadequate reliability; (2) the two-frequency individual test is the most accurate and reliable test for the combined third and fifth grade subjects; (3) despite the above conclusion, the one-frequency individual test and the two-frequency group test can also be employed to test older children; (4) high correlations exist between the one- and two-frequency tests although the differences between these tests are statistically significant.

One- and two-frequency screening has a decided advantage over currently employed screening tests in the rapidity in which it can be administered. This rapidity insures greater accuracy with young children, provides more time for audiometrists to devote to threshold testing, and makes it possible to test more children in a given time thereby increasing the conservation of hearing program. One- and two-frequency screening has an additional advantage of not requiring special audiometric equipment or special test rooms in which to do the screening. In special cases, non-audiological personnel with minimal training may administer the tests. This is possible because of the simplicity of these screening techniques. The efficiency of one- and two-frequency screening in discovering subjects with medically significant hearing loss needs further evaluation. Microfilm $2.00; Xerox $6.00. 123 pages.

ZOOLOGY

A STUDY OF THE GROWTH PATTERN AND HISTOCHEMICAL CHANGES EXHIBITED BY SPECIFIC CELL TYPES IN PELMATOHYDRA OLIGACTIS DURING PERIODS OF RICH FEEDING AND PROLONGED STARVATION

(L. C. Card No. Mic 59-117)

Allison Lee Burnett, Ph.D.
Cornell University, 1958

A histochemical study of the epidermis and gastrodermis of Pelmatohydra oligactis during periods of rich feeding and prolonged starvation has been carried out. The growth patterns exhibited by hydra during these periods were studied by means of vitally stained grafts. An attempt was also made to determine on the basis of histochemical tests the probable functions of a few specific cell types.

The major conclusions drawn from this study are as follows:

1. Pelmatohydra oligactis possesses a growth region just below the hypostome in which constant cell proliferation produces cells that move proximally down the trunk and distally towards the tips of the tentacles where death of these cells occurs. These results confirm the observations of previous investigators working with animals of the same species.
2. Only the digestive cells of the gastrodermis and the epithelio-muscular cells of the epidermis migrate all the way from the growth region to the basal disk. Interstitial cells apparently transform into gland and mucus cells which die before penetrating the peduncle. Cnidoblasts are lacking from the peduncle because being capable of amoeboid locomotion, they travel from the stomach region and budding region distally to the tentacles.
3. As digestive cells migrate proximally and distally from the growth region they pass into regions of different metabolic activity. The digestive cells must absorb food materials for the maintenance of other cell types, such as mucus cells, which appear to be incapable of taking in food from the enteron. Therefore, digestive cells in metabolically active regions such as the budding region, hypostome and basal disk contain, in general, more food inclusions per cell than similar cells in less active regions, namely the stomach and peduncle.
4. Three types of food inclusions, neutral fats, protein reserve droplets, and glycogen granules, are found in digestive cells. Since budding will not occur during starvation after the protein reserve materials have been exhausted, it is concluded that these materials are necessary for cell growth and differentiation. Neutral fats represent an energy reserve which the animal draws upon during starvation.
5. During starvation a reversal of the normal migration process occurs as lipid laden gastrodermal cells from the basal disk and budding region migrate distally, by a process not clearly understood, presumably to nourish similar cells in the stomach region which have exhausted their lipid supply at this time.
6. Four types of gastrodermal secretory cells have been characterized from morphological and histochemical evidence. These are the peristomial mucus cells, stomach mucus cells, peristomial gland cells and stomach gland cells. The mucus cells appear to secrete a substance which facilitates the passage of prey through the mouth opening and enteron. The secretory droplets which are abundant in the gland cells of both regions appear to have an enzymatic function.
7. Two types of birefringent crystals, carotenoids and cholesteryl esters, were identified in hydra. In the enteron these substances are found dissolved in neutral fats and are taken into the digestive cells in this form. After the fats have been utilized by the animal, hydra presumably concentrates the carotenoids by crystallizing them. Microfilm $2.00; Xerox $5.00. 97 pages.

THE LIFE HISTORY AND SYSTEMATICS OF THE GREAT BARRACUDA, Sphyraena barracuda (WALBAUM)

(L. C. Card No. Mic 59-445)

Donald Perrin deSylva, Ph. D.
Cornell University, 1958

The great barracuda, Sphyraena barracuda (Walbaum), family Sphyraenidae, is found in all tropical seas, with the exception of the Eastern Pacific. The following nominal species are considered as synonyms of barracuda Walbaum, 1792: picuda Bloch and Schneider, 1801; becuna

Lacépède, 1803; barracuda Shaw, 1804; barracuda Cuvier, 1829; commersoni Cuvier, 1829; dussumieri Cuvier, 1829; agam Rüppell, 1835; affinis Rüppell, 1835; nuageuse Liénard, 1843; picuda Poey, 1866; snodgrassi Jenkins, 1901; and akerstromi Whitley, 1947. S. kadenar Montrouzier, 1857, and microps Marshall, 1853, are probably synonyms.

Barracuda were collected off Miami, Florida, from Bimini, Bahamas, and specimens from the Danish Oceanographical Expeditions in the Western Atlantic were used. Ontogenetic variation in proportional measurements was determined for 171 specimens from 5.5 to 1111 mm. standard length. Keys for identification are presented for barracuda, guachancho, picudilla, borealis and sphyraena.

Most males of barracuda mature at two years and all mature by three years. Some females mature at three years, and all mature at four. The spawning season is from April until October off southern Florida. Spawning was not observed but probably occurs in the open ocean. The eggs were not identified from plankton tows. Postlarvae were taken far from shore and near the surface, over depths of 200 to 5200 meters.

Age analyses were based upon the scale readings of 555 barracuda, back-calculated lengths from scale measurements, and upon modes in the length-frequency distributions of 2707 specimens from southern Florida. It attains 10 to 12 inches at the end of the first winter, and 18 to 22 inches at the end of its second. It reaches an age of at least 14 years. Maximum length is about 6 feet and a weight of more than 100 pounds.

The young barracuda drifts inshore in spring, spends its first summer in shallow nursery areas, and moves offshore to somewhat deeper water in late fall. During the second summer it enters the mangrove habitat or the deeper weed beds. In the third year it enters the coral-reef habitat. The barracuda migrates seasonally along both coasts of Florida. Some individuals may drift far out to sea.

Young sometimes occur in loose aggregations, but the adults are solitary. Peck order was observed among individuals from 300 to 400 mm. long which were confined in a tank.

Young feed upon atherinids, gobiids and clupeids. Tetraodontiform fishes, hemirhamphids and carangids were most commonly taken by the adults. A change from a shallow-water habitat to that of a reef existence is accompanied by a change in food habits.

A summary of the 21 attacks reputedly made by barracuda on humans is presented and analyzed. Underwater experiences with barracuda are discussed in relation to the factors which are favorable to an attack.

Poisoning in humans who have eaten fresh barracuda is due to a toxin in the flesh and not from bacterial poisoning. In the Western Atlantic, poisonings have occurred from February to November. There seems to be no relation between the attainment of maturity or the spawning cycle, and the poisonous nature of barracuda flesh. Some 58 per cent of the stomachs of adult barracuda contained fishes which are reputedly toxic, of which 20 per cent were tetraodontiform fishes. Evidence is presented for a food-chain origin of the toxin, and mechanisms are discussed for the transmission of the toxin from planktonic and benthic algae to barracuda by way of intermediate organisms. Variations in hydrographic and meteorological features are believed to result in distinct temporal and spatial variation in the toxicity of barracuda as well as other fishes.

Microfilm $5.25; Xerox $17.80. 411 pages.

A STUDY OF THE METABOLISM OF THE EARLY CHICK EMBRYO BY THE USE OF METABOLIC INHIBITORS, IN VITRO

(L. C. Card No. Mic 58-7916)

Lowell Myers Duffey, Ph.D.
Indiana University, 1958

A survey of the literature on the patterns of metabolism in development and the relationships between metabolic patterns and organogenesis indicated a need for further study on the enzyme components supporting embryogenesis. This need was accentuated by a report on observations of the sensitivity of the early embryonic chick heart to critical concentrations of sodium fluoride and the lack of sensitivity in this tissue to anaerobic conditions and critical concentrations of sodium cyanide. The same report held that early brain development is delicately balanced with its capacity for respiration since cyanide, anaerobiosis, and sodium monoiodoacetate effect extensive damage to this tissue type. Conversely, it was reported that the addition of approximately equimolar concentrations of sodium pyruvate or sodium lactate to both fluoride- or iodoacetate-containing media markedly relieved the effects of these inhibitors on heart and brain development, respectively. From this information was formed a hypothesis that the early development of the heart in the chick embryo derives its energy primarily from the Embden-Meyerhof scheme of glycolysis while brain depends on respiration.

Consideration of the known mechanisms of energy-release which support the inconsistencies in the results and interpretations on the actions of these inhibitors on brain and heart, principally the lack of dependence of heart development on respiration and the capacity of brain to bypass the fluoride block of glycolysis, was not rewarding. Consequently, investigations were made on the early chick embryo to determine the validity of the earlier assertions on heart and brain in the presence of fluoride and to clarify the discrepancies between these tissue types for their dependence on respiration. The plan of study involved the explantation and culture of early stages (4- through 9) of chick embryos, in vitro, on a saline-albumen-agar medium into which was incorporated known concentrations of metabolic inhibitors. Investigations were performed on embryos subjected to concentrations of sodium fluoride ranging from 2×10^{-3} molar to 10^{-2} molar for varying (2 to 20 hours) periods of time. These studies revealed that the earliest time of development of fluoride-sensitivity of heart tissue is during the definitive primitive streak stage (stage 4) when the heart tissue is represented by bilateral areas of cardiogenic potency lateral to Hensen's node. Further studies were carried out on the effect of fluoride on the morphogenesis of the stage 4 blastoderm by analysing the inhibition of the maintenance of the length of the pellucid area, of streak recedence, of notochord stretching, and of cellular migrations in the areas of the epiblast lateral to the streak in embryos cultured on control and fluoride-containing media. The analysis of measurements made at 0 and 5 hour intervals during culture indicates that 5×10^{-3} molar and 10^{-2} molar sodium fluoride have a pronounced effect on these developments. Similar studies on the development of the nervous system revealed that the differentiation of the primary and secondary brain vesicles from the neural tube is also inhibited by sodium fluoride. Hence, the picture of fluoride inhibition in the blastoderm

is shown to be more extensive than was originally reported. Furthermore, the original results on the differential sensitivity of the heart and brain to fluoride was contradicted.

The reliance of these two tissue types on respiration has been studied by the incorporation of antimycin A into the culture medium. On the basis of results obtained by culturing embryos (stages 4 through 9) for 20 hours on media containing 0.05 micrograms of the antibiotic per milliliter of medium, heart, somites, and other mesodermal derivatives are revealed to be antimycin-sensitive while brain is comparatively antimycin-insensitive. The report that d-alpha-tocopherol enhances the rate of DPNH oxidation, specifically on cytochrome c reduction, and that the antimycin A inhibition of the DPN̄-cytochrome c reductase of particulates of rat skeletal muscle is reversed by tocopherol, prompted the study of the reversal of antimycin A inhibition in the embryo. The results of these studies showed that concentrations of 50 to 700 micrograms of alpha-tocopherol and 100 to 500 micrograms of alpha-tocopherol acetate per milliliter of medium containing 0.05 microgram of antimycin A were ineffective in reversing the inhibition of somite development and the formation and function of the heart. However, by doubling the albumen concentration of the medium to 30% by volume, the effects of antimycin A were almost completely reversed. It is possible that a component related to alpha-tocopherol and present in small quantities in the albumen, but absorbed by the embryo more readily than the tocopherol, is responsible for the reversal.

These results are discussed in relation to embryogenesis and recent studies on the mechanisms of inhibitions involved in this study.

Microfilm $2.00; Xerox $3.80. 70 pages.

THE METALIMNETIC OXYGEN MAXIMUM IN MYERS LAKE

(L. C. Card No. Mic 58-7917)

William Robert Eberly, Ph.D.
Indiana University, 1958

The heterograde type of oxygen profile is less common than clinograde or orthograde curves. Lakes with a plus-heterograde oxygen distribution in which the sub-surface maximum lies below the level of the thermocline are said to possess a metalimnetic oxygen maximum.

In 1951 (and for four successive summers) Myers Lake in Marshall County in Northern Indiana was found to develop a pronounced and very persistent oxygen maximum at about 8 - 9 meters, well down in the metalimnion. Myers Lake is chiefly a seepage lake located in the glacial drift of the Maxinkuckee moraine. The lake basin has very steep slopes (volume development = 1.17 for the West Basin) which contributes toward the high stability that exists during the period of summer stratification. As with most seepage lakes, the dissolved nutrient level is low, resulting in a rather sparse plankton density in the epilimnion. A consequence of the low plankton population in the upper layers is the high transparency of the lake. Seechi disc transparency occasionally exceeded 6 m, while light transmission as measured by a photometer indicated a mean coefficient of extinction ($k_1\%$) of 0.54, the 1% level of light intensity varying from 7.9 - 9.0 m.

The oxygen maximum occurred most commonly at 8 m depth but varied from 7 to 9 m. Oxygen concentrations at this level ranged as high as 23.3 ppm with mean summer values of 18.35, 19.98, 13.98, and 15.71 ppm for the summers of 1952-1955 respectively.

The oxygen maximum is correlated chiefly with a dense population of Oscillatoria agardhii which is the dominant phytoplankter the year round in Myers Lake. Other alga species include Aphanizomenon flosaquae and Melosira sp. in the upper metalimnion and Gomphosphaeria, Anacystis, and Anabaena in the epilimnion. Myers Lake can be characterized as a "bluegreen-diatom" lake.

Oxygen production was measured using the light-dark bottle method. Daily gross production rates as high as 1377 ug O_2/L were found in the metalimnion with mean values for the days measured of 726 and 754 ug O_2/L at 7 and 8 m respectively. Mean gross production in the metalimnion was over 50% above mean rates for the epilimnion. Highest mean net production rates were at 7 and 8 m with values over four times higher than the highest epilimnial rates. Total gross production in the West Basin averaged 3.94 g O_2 (1.48 g C)/m^2/day.

Average light intensity at the level of the oxygen maximum was about one to two per cent of surface illumination, but the photosynthesis tests showed some assimilation taking place at below 0.5% illumination. Oscillatoria agardhii was producing a dense growth at 8 - 10 m with light intensities estimated at from 200-500 lux and temperatures of about 7 - 9° C. Above that level a mixed population of Aphanizomenon and Melosira was producing large amounts of oxygen in the upper layers of the metalimnion.

The small daily net production of oxygen in the metalimnion can accumulate to form the large maxima observed in the lake only if the metalimnion is protected from turbulent disturbances. The extent of eddy diffusion can be estimated from temperature changes that occur in the clinolimnion. Mean values of the clinolimnetic coefficient of eddy conductivity varied from 0.09 to 0.50. Interestingly enough, the highest coefficient of conductivity occurred in the same year as the lowest mean oxygen maximum, and the lowest coefficient is correlated with the highest mean summer oxygen maximum.

Overall stability of a lake is affected by the shape of the lake basin, climatic conditions early in the spring, degree of protection afforded by the lake's surroundings, etc. Myers Lake is surrounded by a high bank covered by a dense growth of trees. As a result the thermocline forms early in the season at a relatively shallow level (above three meters). As stratification proceeds, the intensity of the thermal gradient increases, making it more difficult for wind-induced turbulence to penetrate the metalimnion. Mean stability of Myers Lake ranged from 466 to 507 g/cm^2, with a positive correlation between stability and mean summer oxygen maxima.

Metalimnetic oxygen maxima in lakes are related to three factors. First, transparency must be such that adequate light for photosynthesis can penetrate into the metalimnion. Second, the metalimnion must be stable, i.e., protected from turbulence which would mix the oxygen-super-saturated layers of the metalimnion with layers of less oxygen content. Such stability is related primarily to the intensity of thermal stratification and the morphometry of the lake basin. Thirdly, algae must be present which are adapted to the conditions of light, temperature, and dissolved nutrients which exist in the metalimnion. Most

metalimnetic oxygen maxima described in the literature have been produced by bluegreen algae.

Microfilm $2.00; Xerox $5.40. 108 pages.

A TAXONOMIC STUDY OF THE MILLIPED FAMILY SPIROBOLIDAE (DIPLOPODA: SPIROBOLIDA)

(L. C. Card No. Mic 59-128)

William Tinsley Keeton, Ph.D.
Cornell University, 1958

The taxonomic history of the Spirobolidae since the publication by Palisot de Beauvois in 1817 of the first species description referable to this family is reviewed. The more important features of the biology and the external morphology of these millipeds are discussed and a definition of the family is given. This definition excludes Messicobolus Brolemann and related genera, Microspirobolus Silvestri and related genera, and Floridobolus Causey. The Spirobolidae, as here defined, are regarded as the most primitive living family of the Spirobolida. They occur only in the temperate areas of North America and China.

The family is divided into two subfamilies. Nine generic names are referred to the Spirobolinae; only four of these are considered valid. Eighteen published specific names are referred to the genus Narceus Rafinesque; only three are recognized as valid. Only one of the five specific names referable to the genus Chicobolus Chamberlin is recognized. Two species are recognized in the genus Aztecolus Chamberlin; two species originally described in this genus are moved to Hiltonius and a third is removed from the family. Two of the four previously described species are accepted and three new species described in the genus Spirobolus Brandt.

A new subfamily is erected to include two genera, Tylobolus Cook and Hiltonius Chamberlin. Two other genera are regarded as synonyms of Tylobolus. Nine species of Tylobolus are recognized; one name is considered a nomen inquirendum. Seven species of Hiltonius are considered valid, two of them provisionally; one name is considered a nomen inquirendum.

Microfilm $3.50; Xerox $11.80. 269 pages.

STUDIES OF THE BIOLOGY AND ECONOMIC IMPORTANCE OF THE CLOVER ROOT BORER, HYLASTINUS OBSCURUS (MARSHAM)

(L. C. Card No. Mic 59-129)

Carlton Smith Koehler, Ph.D.
Cornell University, 1958

By increasing constant temperatures from 15 to 30°C. in 5° increments, the average numbers of eggs deposited per week by each female which oviposited were 2.3 at 15°C., 4.0 at 20°C., and 4.7 at 25°C. The greatest percentage of females oviposited at 25°C. All adults died at 30°C. without ovipositing. Subjecting beetles to increasing conditions of crowding by other H. obscurus adults tended to decrease egg production.

Eggs hatched in an average of 52.7 days at 10°C., 24.0 days at 15°C., 10.8 days at 20°C., 7.3 days at 25°C., and 7.2 days at 30°C. Larvae completed development in an average of 56.4 days at 20°C. and 42.0 days at 25°C. The pupal stage extended for 44.5 days at 10°C., 21.1 days at 15°C., 10.8 days at 20°C., 7.3 days at 25°C., and 9.2 days at 30°C. Eggs failed to hatch at a constant temperature of 35°C.; larvae and pupae failed to complete development at 30 and 35°C., respectively.

A variable number of larval instars was found to be present, with 6 percent of the larvae passing through 3, 80 percent through 4, 13 percent through 5, and one percent through 6 instars. Neither sex, temperature, length of larval stage, nor number of times larvae were transferred from one root section to another, when considered as separate factors, were associated with the variable number of instars. For individuals passing through 4 instars, 11, 9, 13, and 23 days were estimated as the lengths of the larval stadia.

The number of borers present in roots was found to be directly related to root size and inversely related to soil moisture. On considering both factors together, root size was concluded to be the more efficient estimator of borer numbers, with soil moisture probably exerting its effect on root size. A significant linear regression of depth of larvae, pupae, and adults on seasonal progression in weeks was demonstrated, with borers found at greater depths as the season progressed.

Borers were found capable of completing development within roots of plants which died soon after development began. Evidence is presented that development is more rapid in roots of dead than living plants.

The sex ratio of callow adults did not differ significantly from 1:1. In first harvest year fields, females were present in predominant numbers prior to the appearance of new adults, and continued as the predominant sex until the 1:1 ratio, for the overwintering population, was again reached. This ratio was maintained throughout the winter.

In the field, borer control was found to have no influence upon first or second cutting yields in the first harvest year within one area of Oswego County, N. Y. Similar results were found in the laboratory, where degree of borer infestation was considered alone and in combination with watering rate and soil type. Plant longevity during the first harvest year was also not influenced by degree of borer infestation alone or in combination with watering rate and soil type, in the laboratory.

Microfilm $2.00; Xerox $6.20. 126 pages.

THE RELATION OF THE CENTRAL AND AUTONOMIC NERVOUS SYSTEMS TO THE REGENERATION OF LIMBS IN LARVAL AND ADULT URODELES

(L. C. Card No. Mic 58-7860)

Richard Albert Liversage, Ph.D.
Princeton University, 1958

This work was designed to test to what extent a limb can be isolated from the central and autonomic nervous systems and still retain its regenerative capacity. Adults of Triturus viridescens, Amblystoma tigrinum melanosticum, Amblystoma opacum, and Amblystoma talpoideum and

larvae of Amblystoma opacum, ranging in length from 35 to 155 mm, were included in this research. The results were based on a number of experimental approaches and involved a study of 406 experimental and control animals.

In all phases of this work consideration was given to the possible neural pathways for the stimulation of the pituitary-adrenal synergism in urodeles and whether the maintenance of these pathways is essential for regeneration. Limbs and tails were neurally isolated from the rest of the organism by spinal cord ablations leaving, however, a nerve source intact at the local level of sufficient quantity to support regeneration. By repeated ablations of the cord the amputated structures were maintained in an isolated condition from the rest of the organism except for vascular and skin connections. The sites of the ablations were in the lower thoracic, lumbar, and tail regions of the spinal cord, and they were later followed by hindlimb or tail amputation.

It was found that amputated structures regenerate in absence of all central connections with the brain; therefore, stimulation of the animal (especially the pituitary-adrenal mechanism) by way of the spinal cord could not have taken place. It was also found that limbs regenerate when the central nervous system was surgically ablated and the autonomic nervous system was blocked by the utilization of the autonomic blocking agents. Thus, stimulation of the animal by neural pathways presumably was eliminated. Hindlimb regeneration was observed when the lumbar region of the spinal cord was ablated. When the spinal cord and haemal arch in the proximal part of the tail were ablated, the regenerative capacity of the distal tail was retained. Thus, when the central (and lateral line nerves) and autonomic nervous systems were blocked surgically, neural stimulation of the endocrine activities in urodele regeneration was prevented. Deplantation of a limb, plus a segment of spinal cord from a donor animal, was followed by ablation of the host spinal cord underlying the deplant and of lateral line nerves anterior to the deplant. Such a limb retains its regenerative capacity even though it is completely isolated from the central (and lateral line nerves) and autonomic nervous systems of the host and supplied with nerves solely by the deplanted segment of spinal cord.

Inasmuch as nerves do not appear to be necessary on the systemic level for impulse conduction, the remaining possibility is that they are necessary only at the local level. At this level their function presumably is that of providing neurosecretions to the regenerating area. Since the experiments in this research have shown that neural pathways on the organismal level are not necessary, it seems apparent that only a normal hormonal background (homeostasis) is essential in urodele regeneration. Due to the fact that the only connection between the neurally isolated extremities and the rest of the organism is by way of the vascular connections, the possibility that "wound factors" stimulate the pituitary-adrenal synergism was considered. Microfilm $2.00; Xerox $6.40. 134 pages.

STUDIES ON THE LIFE HISTORY OF MESOSTEPHANUS KENTUCKIENSIS (CABLE, 1935) COMB. NOV. (TREMATODA: CYATHOCOTYLIDAE)

(L. C. Card No. Mic 59-407)

Donal Gene Myer, Ph.D.
The Ohio State University, 1958

The life history of the cyathocotylid trematode, Mesostephanus kentuckiensis (Cable, 1935) comb, nov., is elucidated. The cercaria, Cercaria kentuckiensis, is redescribed and the daughter sporocysts, metacercaria, and adult are described. These stages are illustrated by camera lucida drawings and photomicrographs, and are compared with similar stages of closely related species. The cercaria of Mesostephanus kentuckiensis was found in 3.18 per cent of the prosobranch snails, Goniobasis livescens, collected from streams in central Ohio. Daughter sporocysts, but no mother sporocysts, were recovered from crushed snails from which cercariae were emerging. The cercariae were found to encyst and develop experimentally as metacercariae in the common guppy, Lebistes reticulatus, tadpoles of Rana clamitans and R. catesbiana, and adult specimens of R. pipiens.

Fish collected from the Olentangy River near The Ohio State University that were found to be naturally infected with the metacercariae of Mesostephanus kentuckiensis were Ictalurus natalis, Campostoma anomalum, Cyprinus carpio, Notropis cornutus, Pimephales notatus, Semotilus atromaculatus, Amploplites rupestris, Lepomis macrochirus, Micropterus dolomieui, and Pomoxis annularis. A tadpole of Rana clamitans and R. catesbiana, and a specimen of the fish, Micropterus dolomieui, collected from Big Walnut Creek in Pickaway County, Ohio, were also found naturally infected with this metacercaria. Metacercariae were fed to the following experimental definitive hosts: Natrix sipedon, Natrix septemvittata, Procyon lotor, as well as laboratory mice, and one-day-old chicks. Only chicks became infected with M. kentuckiensis. The metacercaria first became infective for chicks after having been in the guppy from twenty-two to twenty-eight days. Eggs of Mesostephanus kentuckiensis first appeared in the feces of experimentally fed chicks after seven days. In the chick, the life span of the adult trematode is between fourteen and seventeen days. Eggs recovered from the feces of infected chicks were incubated in either tap water or 0.5 per cent formalin; however, eggs did not develop for more than a few days.

The possible synonomy of Mesostephanus kentuckiensis and Prohemistomum chandleri based upon the similarity of their cercariae and immature adults is discussed; and the classification of cyathocotylid cercariae is reviewed, and two new cercarial groups are proposed for the reception of cercariae not assignable to groups erected previous to their descriptions.

Cercaria yankapinensis Goodman, 1951 is assigned to the new Tetis (b) subgroup which is separated from the Tetis (a) subgroup in that the former possesses a ventral sucker. A new subgroup, Kasenyi, is erected for cercaria having six pairs of flame cells in the body and two pairs of flame cells in the tail-stem. To this subgroup are assigned the unnamed cercaria of Maxon and Pequegnat, 1949 as well as Cercaria kasenyi Fain, 1953, Cercaria schoutedeni Fain, 1953, and Cercaria multiplicata Premvati, 1955. The relationships of the family Cyathocotylidae to other

families of the suborder Strigeata, based upon larval characters, are discussed.

Microfilm $2.00; Xerox $5.40. 109 pages.

SOME ASPECTS OF TRACHEAL VENTILATION IN THE COCKROACH, BYRSOTRIA FUMIGATA (GUERIN)

(L. C. Card No. Mic 59-408)

Theodore Blow Myers, Ph.D.
The Ohio State University, 1958

In order to amplify and to make quantitative the observable reactions of the ventilatory movements of the cockroach, Byrsotria, an insect spirograph was devised which enables experimental gases, controlled by flow-meters, to be blown over the insect. The roach is kept stationary in a wire screen immobilization cage which is held within a plastic ventilation chamber. Insect pins thrust through the cage hold the insect in a normal body position. The cockroach is connected to a heart-lever by means of a fine thread sewn to a dorsal abdominal tergite. The lever traces a spirogram on a kymograph drum.

Studies of rate, amplitude, and form of the breathing motions of this animal show periods of compression, expiration, decompression, and return to the pre-compressatory condition. The quiescent female roach breathes discontinuously; slow bursts of about five movements alternate with long periods of apnea.

Four types of ventilatory movements are found in Byrsotria: (1) basic eupneic contractions which occur infrequently and mark the quiescent animal; (2) accelerated movements found upon stimulation with carbon dioxide concentrations above 10 per cent; (3) active telescoping movements which occur in the recovery period after narcotization with carbon dioxide; (4) continuous, slow patterns of contraction which take place after the removal of cephalic nerve centers. After the extirpation of the supraesophageal ganglia, the abdomen contracts in a series of deep movements alternating with short periods of apnea. Upon removal of both supra- and subesophageal ganglia, the slow, deep movements become continuous and may last for several days.

Experiments in which the thoracic ganglia were excised, or in which the nerve cord was cut in that region, gave respiratory results similar to those of decapitation. Removal of abdominal ganglia or the section of the cord in that region presented various modifications of the respiratory pattern. No ventilation took place, however, after the removal of a combination of the first four abdominal ganglia. This region is thus indicated as the site of the respiratory center.

The results of experimentation in which a separation chamber was used to isolate the body regions of the cockroach by means of rubber membranes indicate a directed stream of air passing in through the first four pairs of spiracles and out through the last six pairs of openings. When smoke is allowed to enter the first four pairs of spiracles, it is forcibly exhaled through the sixth and eighth pairs of abdominal spiracles.

The abdomen, when completely separated from the thorax immediately posterior to the metathoracic ganglion, is capable of performing continued respiratory contractions and can modify its rate of breathing in response to carbon dioxide stimulation.

Microfilm $2.00; Xerox $4.60. 89 pages.

THE LIFE HISTORY AND ECONOMIC IMPORTANCE OF MOCHLONYX CINCTIPES (COQUILLETT) (DIPTERA:CULICIDAE)

(L. C. Card No. Mic 59-410)

Charles Timothy O'Connor, Ph.D.
The Ohio State University, 1958

The non-biting Culicidae, which form the subfamily Chaoborinae, have been largely neglected by entomologists. The facts concerning the life history of Mochlonyx cinctipes (Coq.) and its economic importance with regard to mosquito reduction were obtained under both laboratory and field conditions.

Descriptions and illustrations of the various stages of the life history are presented. Head and siphon measurements were found to be useful in separating larval instars.

Mochlonyx cinctipes (Coquillett) breeds in semi-permanent woodland pools formed by melting snow and spring rains. There is one generation a year and the winter is passed in the egg stage. The larvae appear at the beginning of March, and the adults appear at the end of April or the beginning of May. The adults are no longer present after the middle of June.

The larvae are omnivorous, feeding on crustaceans, mosquito larvae, algae, and fungi. They are capable of remaining beneath the surface of the water for extended periods. Under crowded conditions, cannabalism is a common practice.

Adults were not observed to feed, although they do imbibe water. They swarm in the evening, and the females oviposit under leaves and other debris at the periphery of the pools. The adults remain in close proximity to the pools and pass most of their lives resting on tree trunks.

The larvae of this species are not considered important in the control of biting mosquitoes because of their omnivorous habit, sparse distribution, and long life cycle.

Microfilm $2.00; Xerox $5.00. 97 pages.

THE TRANSFORMATION OF ENERGY BY DAPHNIA PULEX

(L. C. Card No. Mic 58-3725)

Sumner Richman, Ph.D.
University of Michigan, 1958

The purpose of this study was to determine the energy budget of Daphnia according to the equations:

$$\text{input} = \text{growth} + \text{respiration} + \text{egestion}$$
$$\text{assimilation} = \text{growth} + \text{respiration}.$$

From these measurements the efficiency of converting consumed energy into new protoplasm (gross efficiency) and assimilated energy into new protoplasm (net efficiency) was ascertained. Four concentrations of the green alga Chlamydomonas reinhardi were employed to determine the effect of different concentrations of available food on the energy budget. All of the experimental work was carried out at 20°C and in the absence of light.

Energy input was calculated from the rate that Daphnia filtered algae and the calorific value of the algae. The filtering rate is defined as the amount of water swept free of cells per unit of time per Daphnia and was determined by differential algal cell counts. It was found to be independent

of algal concentration and increased with increasing size of daphnids. The filtering rate per unit weight of daphnids decreased with increasing size. The calorific value of the algae was measured with a micro-oxygen bomb calorimeter and was 5269 cal per gm. This was equivalent to 1.308×10^{-6} cal per Chlamydomonas cell.

Energy expenditure was measured by the method of indirect calorimetry. Oxygen consumption measurements were made according to the Warburg technique and the water bottle method. Carbon dioxide production was determined by measuring pH changes in the same experimental water bottles as used for the oxygen determinations. The respiratory quotients of non-fasting Daphnia ranged from 0.92 to 1.24. Oxygen consumption was independent of the amount of food the animals consumed whereas carbon dioxide production decreased with increased periods of starvation. The daily respiratory quotient of animals starved for five days dropped from 1.13 to 0.71. The heat production of the fed animals was calculated by taking the calorific value of one microliter of oxygen to be equivalent to 0.005 cal.

The growth and reproduction rates were determined for forty days at the four food concentrations beginning with newborn daphnids. During this time the animals lived through eighteen instars and produced an average of thirteen broods of young. After the first eight days of life, the amount of growth was greater in higher food concentrations, as was the number of young per brood. Length increases during the growth experiments were converted to increases in biomass by means of a length-weight relationship.

In order to determine the calorific value of the biomass increments during growth, the calorific value of the Daphnia was measured by bomb calorimetry. The average calorific values of 0.7, 1.3, and 1.8 mm animals were 4059, 4124, and 5075 cal per gm respectively. The high calorific content per unit of dry weight of the latter group was attributed to a high proportion of fat in the ovaries or eggs of these animals.

An energy budget for pre-adult and adult animals showed the effect of age and amount of food consumed on the gross and net efficiencies of growth. Combining the energetic relationships of the pre-adults and adults and the energy in the production of young, a total energy budget of Daphnia after forty days of growth and reproduction is presented. The gross efficiency of growth decreased from 17.43% to 10.01% with increased algal consumption. This can be attributed to the increase in egestion with increasing food. The net efficiency of growth, however, increased from 55.99% at the low food concentration to 72.98% at the high food level. Microfilm $2.00; Xerox $3.80. 69 pages.

THE DEVELOPMENTAL HISTORY OF THE CHIRONOMID AND CHAOBORUS FAUNAS OF MYERS LAKE, AND THE RELATIONSHIP OF THESE FAUNAS TO MICROLAMINAE IN THE SEDIMENTS

(L. C. Card No. Mic 58-7934)

John Benton Stahl, Ph.D.
Indiana University, 1958

Chironomid and Chaoborus larvae have been extensively used in lake typology. By recovering and identifying the remains of these organisms preserved in the sediments of a lake it is possible to determine the changes in typology that have occurred during the lake's ontogeny.

A core 10 m long was obtained from the profundal zone of Myers Lake. This core is believed to extend almost to the original basin of the lake. Sergentia coracina was found to have been dominant initially and for a major part of the lake's ontogeny. This midge occurred previously in two other Indiana lakes and lives now in three others. These facts are interpreted as meaning that Myers Lake initially had moderately severe hypolimnetic oxygen depletion, and that this oxygen depletion gradually became so severe, primarily because of a reduction in the volume of the hypolimnion, that Sergentia was eliminated. Later in the history of Myers Lake, but while Sergentia was still dominant, Chaoborus punctipennis became abundant. Considerably later Chaoborus flavicans entered the lake, but has not become nearly as abundant as the former species. These two organisms are virtually the only macrobenthos living in the lower profundal zone of Myers Lake at the present time. Sergentia remains per ml wet sediment exhibit two maxima and two minima. The first minimum occurs in the lowermost sediment. These fluctuations are believed to be due primarily to changes in the productivity of Sergentia. No obvious correlation between climate or organic matter of the sediments exists. Considerably greater numbers of midge remains were found in a sublittoral core. All these were of shallow-water forms. Their occurrence in small numbers in the profundal core is apparently due to redeposition from shallow water. An inexplicable positive relationship exists between numbers of Plumatella statoblasts and Sergentia heads.

Microlaminae (each 0.1-0.3 mm thick) were present in a considerable portion of the profundal core. These laminae were apparently produced by fluctuations in carbonate deposition. Because of an absence of any correlation between these laminae and the numbers of chironomid remains the theory that the mixing activities of bottom organisms are responsible for the absence of laminae is probably erroneous.

Chironomus staegeri larvae (each 20 mm long) were kept in small jars filled with gyttja and placed in an aquarium with a continuous supply of oxygen-rich water. By means of photographs it was determined that a fivefold increase in the area of sediment oxidized was produced by these larvae. Larvae 10 mm long oxidized only twice as much sediment as was oxidized in the control jar, without larvae. The significance of this oxidation and of other effects of the profundal faunas on the sediments is discussed.

Profundal sediments from eight lakes were kept in small jars in a 10°C room for three months. Three pairs of laminae developed in two of the jars. Reports of microlaminae were compiled. Lamina formation by chemical diffusion and interaction has occurred only in sediments kept in vitro at a temperature of at least 10°C. It appears that all in situ microlaminae are due to fluctuations in the amount of carbonates, plankton, or clay and silt.

Microfilm $2.00; Xerox $7.20. 152 pages.

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